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ABSTRACT

Examined with 297 primary grade children were the effects on reading ability of matching a child's learning style with a compatible teaching method. After Ss' auditory or visual modality preference had been determined they were randomly assigned to classes so that 1/3 of each class showed an auditory preference, 1/3 showed a visual preference, and 1/3 had no preference or showed balanced development. Classes were instructed using either an auditory approach, a visual approach, or a balanced approach. The Ginn 360 reading series was adapted for either a visual or auditory emphasis, and teachers attended an 8-week summer inservice training session. Results for grade 1 indicated that children who showed an auditory preference achieved significantly higher when auditory decoding techniques were used and children with a visual preference achieved significantly higher when visual techniques were used. The hypothesis could not be validated for the 2nd and 3rd grades due to attrition of Ss though it was noted that all Ss receiving the visual training achieved higher than expected reading scores. (DB)

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FINAL REPORT

Section II

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PERCEPTUAL DEVELOPMENT AND LEARNING: AN EXPERIMENTAL STUDY ON MODALITY READING INSTRUCTION

by

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PREFACE

The Final Report fulfilling the National Institute of Education Contract #NIE-C-74-0026 is in two sections. Section I is a Monograph by the Principal Investigator entitled "Perceptual Processing Development: Its Relation to Learning and Learning Disabilities." Section II is a report of a research experiment which tested the idea that matching a child's learning style as determined by his perceptual ability to a compatible teaching method would increase his progress in learning to read. This study is reported by the Project Director.

The study which was conducted in an elementary school in Dubuque, Iowa was begun in 1972 with the support of the Office of Education through the National Program for Early Childhood Education (CEMREL). The first year was devoted to making a determination of the perceptual modality status for all of the children in Kindergarten, 1st and 2nd grades.

The second year support for the study was transferred to the National Institute of Education. This stage of the study was concerned with planning for instructional intervention with the staff of the school during the summer months and in September 1973 with the actual matching and mismatching of children's learning styles as determined in the first year of the study to the planned variations in instruction according to classrooms.

ACKNOWLEDGEMENTS

It is with great appreciation that we thank Mr. Richard Zimmer, Principal of Table Mound School, Dubuque, Iowa, and his wonderful staff of teachers who so enthusiastically facilitated this experiment in teaching, an experiment in learning.

We are also grateful to the examiners who individually administered the perceptual tests to the children. And, of course, we are forever indebted to the children who participated in the study.

We were very fortunate also to have to excellent statistical consultants, Spencer Swinton during the early stage of the study and Mark Reiser during the later stage.

Anne Morency
Joseph M. Wepman

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SECTION II

Field Study

PERCEPTUAL DEVELOPMENT AND LEARNING

CHAPTER I

DEFINITION OF THE PROBLEM

Introduction

In the past, studies into the various aspects of understanding or predicting elementary school achievement found the most cogent factors to be the intellectual ability of the children or the state of their mental health. Individual differences in one or the other or both factors in regular classrooms could be readily rationalized and translated into accounting for the extremes or deviations in the relatively normal distribution of achievement. Where problems were so severe that they could not be dealt with in the normal classroom, special education evolved that provided instruction that was directed to maximize the potential of the intellectually retarded, or, in some cases, the gifted and the emotionally disturbed. The fact that many childrens' difficulties with learning the basic skills did not fit either of these categories or an interaction of the two has been dealt with only in the last few years. The identification of perceptual ability as being a necessary precursor to conceptual learning has been a turning point in the study of the development and the education of children. The reader is referred to the Monograph entitled: "Perceptual Processing Development: Its Relation to Learning and Learning Disabilities" by Joseph M. Wepman, November 1974 for an in-depth discussion of the perceptual basis for learning.

The area of special education has seen the most dramatic changes. For example, the existence of classes for brain-damaged children as well as classes for children with specific learning disabilities are now commonplace in most urban areas. It is not uncommon to find several different types of special education classes accommodating a broad spectrum of exceptional children in communities of all sizes throughout the country.

The serious study of perceptual processing ability and the effect that nuances of variations in its development has on the normal child in early elementary school has been relatively slow in gathering momentum.

Since the perceptual modality concept in its present form was first proposed by Wepman in 1957 (Osgood & Miron, 1963) and the very similar model suggested by Osgood (ibid) a wide variety of research, testing, and remedial practice has ensued. The ITPA, probably the most widely known of tests for linguistic accomplishment, was directly based upon it (McCarthy & Kirk, 1963); and, of course, all of the research and use of that test confirm the applicability of modality distinctions and modality preference and in some instances instructional methods were considered (Bateman, 1965, 1968). Studies by DeHirsch, Jansky and Langford (1965), Sabatino (1968, 1971), Cohen (1969), Sabatino and Hayden (1970) are all illustrative of the use of batteries of tests devoting attention to modality distinctions and in most instances to the necessity for studying the perceptual processing ability of children. Most of the work in the area has been carefully collected and annotated in NINDS, Monograph 9, Central Processing Dysfunctions in Children (Chalfant & Scheffelin, 1969). Frostig (1964), for example, has explored at considerable depth the role of the differential development of visuo-motor perceptual ability, while Birch (1965) as another example has concentrated on cross-modality function.

Most recently Robinson (1972) completed a study comparing reading progress through the third grade of pupils on a paradigm of high/low modality distinctions--visual and auditory--upon entering first grade and when taught in differing school systems that utilized reading systems which were identified as primarily phonic and primarily visual in instructional approach. Robinson used the Wepman Auditory Discrimination Test and three visual perceptual tests by Goins (1958) to base her high and low auditory and visual ability groups. Robinson's study agreed with the Bateman (1968) study regarding efficacy of the auditory or phonic approach to teaching reading. Robinson also found that children who were high overall perceptually did the best in reading regardless of teaching method. Those who were low perceptually did the worst and those with a high/low rating were inbetween.

That phonics is the most efficient technique to teach reading or that perception when viewed quantitatively is predictive for reading achievement is not the issue taken by the present investigators in this study or in past explorations into modality development and perception. Perceptual imbalance when it exists in children in the early grades is viewed here as an individual difference that may need to be reckoned with by adapting expectations for performance and also where appropriate and feasible, instructional tactics, in order to maximize a child's learning potential.

The first phase of our own work on this aspect of learning in children oriented to modality preference and development is reflected in the literature by a chapter in the Supplementary Educational Monograph, Volume XXVI, Meeting Individual Difference in Reading (Robinson, 1964), entitled: "The Perceptual Basis of Learning" and by publications on Auditory Discrimination, Speech and Reading (Wepman, 1960); "The

Interrelationship of Hearing, Speech and Reading" (Wepman, 1961). The goals of our recent past research programs have been concerned with identifying those perceptual processes which contribute to conceptual learning and to developing methods for assessing the level of attainment in each of the identified processes. It was during this period of time that the Perceptual Test Battery (PTB) which includes the following subtests: Auditory Discrimination Test (Wepman, 1958); Auditory Memory Span Test (Wepman & Morency, 1973a); Auditory Sequential Memory Test (Wepman & Morency, 1975b); Visual Discrimination Test (Wepman, Morency & Seidl, 1975a); Visual Memory Test (Wepman, Morency & Seidl, 1975b) and The Visual Orientation Test (Swinton, 1973) was developed and standardized. These studies found that 1) there is a consistent increase in perceptual ability with age; 2) children vary in the rate of development, both within modalities and between modalities; 3) the normal development of perception does not reach fruition in some children until the ninth year.

In addition, previous research on the modality concept and using the Perceptual Test Battery has (1) demonstrated the usefulness of determining the degree of development in each modality at the perceptual level of so-called normal children for a) predicting the acquisition of accurate speech articulation (Wepman, 1960); b) for predicting the likelihood of difficulty in reading achievement in the first three grades (Morency, 1968); and c) determining the modality preference of children, and, thereby, inferring educational emphasis of choice in early school training (Wright, 1972;) (2) established the relationships between early perceptual (sensory and sensori-motor) development and later school achievement (Morency, 1968).

The present investigation logically follows these studies by focussing on the effect different approaches to teaching reading in the early elementary grades had on children who had balanced modalities versus those who had unbalanced modality development on the perceputal level of learning.

Theoretical Background*

The construct on which the present research is based is a developmental psychoneurological one which has been widely expounded in the literature by the principal investigator (1963, 1964, 1968) and others (Osgood, 1963). Briefly, the concept holds as the model in Figure 1 indicates that a developmental hierarchy exists in each child wherein he proceeds from birth through approximately his eighth year using his concurrently expanding neurological potential for more and more complex behaviors. Three levels or gradations of behavior are identified--the reflex, the perceptual, and the conceptual. Each level or gradation depends for its complete maturation and function upon preceding levels. At each level, the various sensory pathways (modalities) are independent, all feeding into a common central encephalic process which in turn selects the mode of output.

Figure 1 goes here

As the model shows, a perceptual level is postulated lying between the innate reflex capacity and the higher level of conceptualization. At this level without conscious recognition the child develops the capacity to discriminate, retain, recall, sequence and orient auditory, visual and tactile/kinesthetic stimuli. His capacity to perform these manipulations of signals improves as his neurological system becomes differentiated. The rate and degree of such development differs from child to child and from modality to modality.

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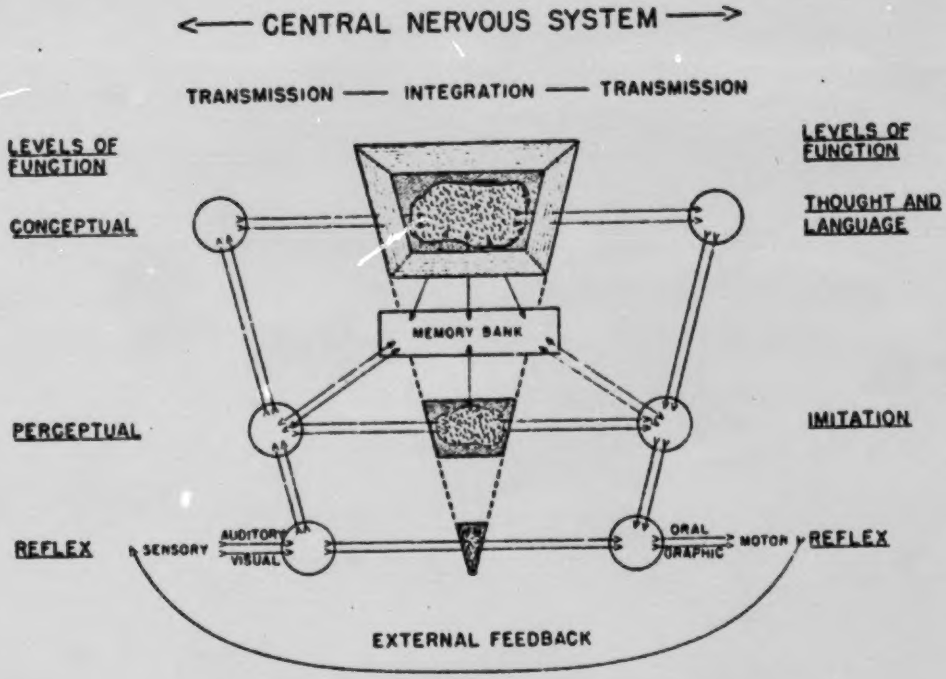
*The reader is referred to Section I of this report which is the most comprehensive writing available on the subject, a monograph entitled, "Perceptual Processing Development: Its relation to learning and learning disabilities" by Jos. M. Wepman, Nov. 1974. Supported by DHEW, NIE Contract #NIE-C-74-0026.

Figure 1.


CENTRAL NERVOUS SYSTEM
TRANSMISSION — INTEGRATION — TRANSMISSION
LEVELS OF FUNCTION
CONCEPTUAL
PERCEPTUAL
REFLEX
SENSORY
AUDITORY
VISUAL
MEMORY BANK
LEVELS OF FUNCTION
THOUGHT AND LANGUAGE
IMITATION
ORAL
GRAPHIC
MOTOR
REFLEX
EXTERNAL FEEDBACK

AN OPERATIONAL DIAGRAM OF THE LEVELS OF FUNCTION IN THE CNS

At this level the child acquires his phonemic/phonetic knowledge permitting the auditory monitoring of his speech. He simultaneously develops increased motor coordination; and somewhat later his recognition and differentiation of forms and their postures permits his learning an orthographic alphabet.

Finally, although simultaneously in part, he develops his conceptual abilities, his understanding, his decoding capacities. Only, however, when he has developed adequate and sufficient perceptual ability can he bring to normal fruition the conceptual processes involved in language comprehension and use. Verbal behavior requires the formulation of symbols based upon a previously learned alphabet of sounds (for speech) and letters (for reading, spelling, etc.).

Rationale

It would seem, then, that one of the possible significant individual differences in young children which contributes to success in learning to learn is based on the rate and degree of modality development. Logically, it would appear that with children who are balanced in modality development, the various techniques of teaching reading would be of no particular concern. However, those children who evidence an imbalance, therefore effecting a preference or facility in either the auditory or visual modality would find enhancement in ability to learn if the instructional approach matched the preference. It also follows logically that if the preferred pathway for learning was ignored or only partially utilized in the teaching process that the learning could be slowed down.

The nuances of these situations have not been previously explored using an experimental design 1) that permitted identification of the children relative to their modality development, balanced or unbalanced, prior to experimental intervention; 2) that employed a battery of tests designed especially to explore perceptual level functioning rather than conceptual functioning or a combination of perceptual and conceptual functioning; 3) that utilized planned instructional intervention for the experiment by adapting an existing reading series to increase visual techniques in the classrooms aimed at matching children who show a visual preference, classrooms increasing auditory techniques to match children who show auditory preference in addition to classrooms that did not alter the teaching methods outlined in the reading series; 4) in which the children were not homogenously grouped according to their preference. Each classroom had three groups of children, one group showing an auditory preference, one a visual preference and one balanced or no preference.

Thus, the present study concentrates upon the perceptual level of development in children five through eight years of age but specifically on the interaction between modality preference as expressed by an imbalance in development between the dual modalities, auditory and visual, which are the primary pathways for school related learning and teaching method.

Hypothesis

The hypothesis which evolves from the foregoing discussion with which this study is concerned is as follows:

> Instruction in reading, when matched with the unimodal learning styles of the children who have a modality preference will result in higher achievement scores than those children whose unimodal learning styles are mismatched to modality related instructional techniques.

Schedule of Procedures

To test the hypothesis (stated on page 8) an experimental pre-post achievement test design was utilized. The following is an outline of the schedule of investigation:

1) First year of the study. The determination of modality status was made on all of the Kindergarten, 1st, and 2nd grade children of Table Mound Elementary School.
2) Preparation of materials and coordinated lesson plans were worked out for adaptation of the Ginn 360 Reading Program during an 8-week Summer Workshop attended by the teaching staff of Grades 1, 2, and 3. The principal of the school and the investigator attended several sessions as observers and consultants.
3) The second year of the study the children were randomly assigned to classrooms as follows: one-third (approximately) of each classroom was made up of children who showed an auditory preference; one-third (approximately) a visual preference; one-third, no preference or balanced development (henceforth called, Auditory, Visual, and Either children).

The first three grades used the Ginn 360 Series with adaptations made to facilitate the experimental design. The first grade* had two classrooms in which the approach in initial teaching was auditory and two classrooms in which the initial approach was visual. The second and third grades had one classroom that utilized auditory methods, one that utilized visual and one control classroom (henceforth to be referred to as Auditory, Visual and Control Classrooms) that used the selected readings without any adaptations being made.

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*See page 22 for explanation.

CHAPTER II

YEAR 1 - DETERMINATION OF MODALITY STATUS OF THE SUBJECTS

The first year of the study was devoted to determining unimodal perceptual preference as well as bimodal ability of the children who were the subjects in this study.

The instrumentation for this experiment began when each child in the Kindergarten, 1st and 2nd grades was individually administered the six subscale Perceptual Test Battery (see Appendix A for description of the tests). Three of the subscales were auditory and three were visual. The perceptual parameters which were measured were:

1) auditory discrimination
2) auditory memory
3) auditory sequential memory
4) visual discrimination
5) visual memory
6) visual orientation memory

There were 297 children in the three grades who were tested during this phase of the study. The team of examiners were local substitute or former teachers who were individually trained and initially supervised by the present investigators during the month prior to actual administration of the tests. Their training was approached first by the introduction of the concept of the perceptual basis for learning. The tests were then examined together by the group. Instructions were read aloud as the examiners read the same information to themselves. The test materials were distributed to each individual in the team to keep during the training period. They were instructed to give the tests to as many children as they felt necessary to feel familiar and comfortable with the guidelines of administration and recording. At a later date, a group of 5, 6, 7, and 8 year old children were provided by another elementary school in Dubuque so that each examiner could check out her accuracy and uniformity in administering the tests. Each examiner gave the six perceptual tests to these children, one at a time, while the investigators observed. If an examiner deviated from the instructions for giving or recording a test, that test was re-administered until the testing technique was uniform. Special instructions which from past experience were deemed important to large scale testing were given to the team of examiners in addition to the standardized Manual of Directions for the administration of each test (see Appendix A). The testing was conducted in a three-week period during the first thirty days of the beginning of school in the fall of the first year of the study.

The modality status, unimodal preference or bimodal, of each child was determined by the following procedure:

1) Each raw score was converted into a scaled score. The increments of the scaled score were based on the cumulative frequency distribution of this population by age. Table 1 shows the distribution and conversion and interpretation of the scaled scores.

TABLE 1

Distribution and Scale Score Conversion of PTB Scores

Developmental Level	Raw Score Percentile	Scaled Score
Excellent	15%	+2
Good	20%	+1
Average	30%	0
Fair	20%	-1
Poor	15%	-2

2) After obtaining the scale score for each test, the following formula was applied:

Sum of Scaled Auditory Scores ± Sum of Scaled Visual Scores

In this calculation the plus and minus signs of the scaled scores are observed *within* the modalities and *between* the modalities. The modality status that was determined for each child was arbitrary and thus became a part of the experiment. A child was designated as having an *auditory preference* if there were two or more points between the sum of scaled scores, the within-in auditory scaled scores being the highest. A child was designated as having a *visual preference* if the two or more points went in the direction of the sum of the visual scaled scores. When there was less than two points of difference between auditory and visual sum of scaled scores a child was considered to be bimodal and given the designation *either*, implying no modality imbalance thus no preference. A fourth category was made up of children who had four or more minus scale scores (regardless of the sum) out of a possible six. These children for this study were considered not perceptually adequate and were not included in the study.

The results of Part I (year 1) of the study are shown in Table 2.

TABLE 2

Distribution by Grades of Children According to Perceptual Status

Modality Status Grade	Auditory N %	Visual N %	Either N %	Neither N %	Total N %
K	31 = 27%	40 = 34%	32 = 27%	14 = 12%	117 = 100%
1	31 = 28%	30 = 28%	30 = 28%	17 = 16%	108 = 100%
2	26 = 36%	23 = 32%	23 = 32%	------	72 = 100%
	88 = 31%	93 = 31%	115 = 39%	31 = 10%	297

The above distribution was felt to be satisfactory for embarking on the second stage of the study. The 10% Neither category of children was in keeping with prior estimates that 10 to 15% of all children entering school are not ready perceptually to take on the primary grade related task of learning to read. The division into roughly "thirds" of children who showed an auditory preference, a visual preference and either (balanced; no preference) provided a good balance for random distribution into classrooms for instructional intervention.

CHAPTER III

INTERIM SUMMER WORKSHOP

The second year of the investigation was devoted to testing the study hypothesis. However, the instrumentation for this project began in the summer months prior to the beginning of the school year 1973-74.

There are at least two ways to approach the implementation of matching teaching methods to learning styles of children.

One is to incorporate the use of separate reading programs that are conceptualized and written to utilize the auditory and visual pathways separately as much as possible by coordinating all instruction in the use of particular teaching techniques such as phonics for word analysis (auditory learning style) or letter and whole word emphasis (visual learning style).

An alternate way is to select one basic well written reading program and adapt the initial approach to instruction in word analysis, word recognition and the like to a particular learning style. For several reasons the latter approach was the method chosen for this study. In the first place it was the desire of all concerned with this investigation to not disrupt the status quo of the local elementary school any more than necessary. The Dubuque School Board had previously adopted the Ginn 360 Reading Series (Clymer & Barrett,1970) for use in all of its elementary schools. Also, in the long run it was in the interest of economy of time and money to see if a basic series could be adapted to the learning styles of children.

If this were feasible, a teacher in a classroom would be able to have separate reading groups divided on a different basis than the usual high or low ability of the children. The Ginn 360 is fundamentally a series of basal readers with supplementary material in phonics. There is strong emphasis on decoding which is taught by the discovery of sound-letter relationships which are common to words selected from the instructional materials. The control rooms usedthe Ginn 360 as published.

Adaptation of Reading Series

Under the direction of the principal of Table Mound School, the staff of teachers of the 1st, 2nd and 3rd grades met for an 8-week workshop to develop strategies and materials for use in adapting the Ginn 360 to the specifications of the experimental classrooms. The investigators attended these workshops, serving as consultants.

It was decided not to delete any of the material of the 360 series. All of the children in all of the classrooms were to receive the same basic material; (reading periods were conducted each day for a uniform length of time for all of the classrooms). In the experimental classrooms, however, all of the initial instruction introducing a new topic or concept was to be either auditory or visual. Since it is impossible to learn to read if one modality is excluded, the initial unimodal introduction was planned to be followed up with the necessary support to complete the concept being taught. Visual and auditory aids that were felt to be desirable or necessary were designed by the staff. Filmstrips, transparencies, tape recordings, and the like were constructed to aid the teachers in their task of adaptation. The materials already available in an audio-visual resource room (learning center) were catalogued relative to their usefulness for the auditory and visual classrooms. The

Teachers' Manuals were adapted, objective by objective, for the experimental classrooms. Where the original 360 material did not match a specific experimental classroom's emphasis, special techniques and material--if necessary--were incorporated so that they did match.

One plan that clearly demonstrates a difference between the auditory and visual classrooms is the following: In teaching the graphemic base /oo/ the teacher in the auditory classroom would say "good" and "took" and ask the children what vowel sound they heard. She would then ask them to think of other words that sounded the same. She, in addition, might enlist the use of the tape recorder so that the children could hear other voices saying alot of /oo/ words and also hear them used in sentences. The teacher would then fill out her instruction by writing the words on the board and she might read them aloud or have the children read them and then note the similarities and differences in how they look and how they sound. The visual classroom on the other hand would approach the /oo/ base by writing "good" and "took" on the board and ask the children what similarities they saw. She would then write other /oo/ words on the board, drawing the double o's in colored chalk. She then could have the children pick out /oo/ words from a list of various different words printed on a poster or on the board. She could then read the /oo/ words with the children pointing out the similarities in the /oo/ sounds and the differences in the initial and ending consonant sounds.

Examples of Adaptation

Further examples of ideas for the differential presentation appropriate in the experimental classrooms of the three grades will further clarify the auditory and visual orientations as developed during the workshop.

First grade, using graphemic bases as a model:

Auditory: Without introducing the printed word, the word is spoken, such as "hill" and the children are asked "What graphemic base do you hear?" "What new beginning consonant sound can be said as "Bill,"will," "fill," etc. are given." The students are then asked to say the consonant sound in isolation. Next, they are asked to point to the letter representing that sound and then the entire word list is shown and the students are asked to say - the words.

Visual: The base "ill" is shown to the students either on the overhead, chalkboard (using one color of chalk), letters cut out from construction paper, or made from clay. Various consonant letters of another color are placed in the front of the base, attention is drawn to the new letter as to size and configuration and the word is pronounced in total, not in phonemic parts. The children are asked, "How is the new word pronounced?" and not "What sound/sounds do you hear?"

Second grade, using vowels as a model:

Auditory: When teaching vowels auditorily, the initial presentation is made totally from a listening approach. For example, when teaching unglided e, the teacher says a word containing that sound - "let" - giving directions for the children to listen for the sound in a specific place - "What sound do you hear in the middle of the word?" A child is then asked in isolation - /e/. The sound is then given a name - unglided e. After the sound can be recognized, reproduced, and named by all the children, the word is written on the board to learn what letter stands for that sound - e.

Visual: The visual method of teaching vowels presents whole words first. Several words with the same vowel type are written on the chalkboard or overhead projector. For example, "let, bed, Ben." The children are asked to look carefully at the words and tell what they see that's the same about every word. The students indicate that "All the words have an 'e' in the middle." The teacher then draws attention to the middle 'e' by underlining it. The students then pronounce the words. Draw attention to "feeling" how the middle letter is pronounced in the mouth and throat. (Unglided 'e' is pronounced at the base of the throat and with pressure of the fingers on the neck one can feel where it is vibrating.) The pronunciation of the medial 'e' is then named "unglided e". After this initial approach visual clues of spelling patterns (Example: Consonant - Vowel - Consonant) are used to decide if a word might contain an unglided vowel before it is pronounced or heard by the students.

Third grade, using consonant clusters as a model:

Auditory: When introducing a consonant blends skill such as tr, is usually started by giving the class several examples such as tree, trip, track. Then they are asked such questions as: "What sounds do you hear at the beginning of each word that are alike? What two letters make that sound? Can you think of any more words that begin with the same sounds?" For more practice in sound recognition and discrimination, the teacher also says a list of words such as tray, stay, drop, track, green, trip. The students would tell if they hear the tr at the beginning of each of these words.

Visual: Possible ways to introduce initial tr consonant cluster-- On board or overhead, the teacher writes the tr in one color, the rest of the word in another, drawing the student's attention to the tr. On board or overhead, the teacher writes a list of tr words, then asks the students what they see that is the same in each word, then has the students underline or circle the initial tr. Using prepared worksheet, the students put tr in a blank to complete a word, then the word is written in a blank to complete a sentence. After the list of tr words are introduced, a worksheet is used and the students match the word with the correct meaning. Using small cards with tr on them and other cards with bases on them, the students put the two cards together to make as many words as possible. The words are then compiled on the board for the entire group's use. After a list of words is introduced on the board or overhead, the students copy the list on their own paper, then use each in a sentence. (For actual adaptations to level 3 of the Ginn 360, see Appendix B.)

To carry out the single modality emphasis a step beyond specific instructional techniques, the classrooms were planned to be furnished differently. Auditory classrooms were to be equipped with tape recorders and earphones in order to facilitate auditory learning in general. The visual classrooms were planned to be just the opposite. There were to be no tape recorders and the like. Instead emphasis was planned around visual material such as books, pictures, posters and blackboard instructions all of which were to be made available for all aspects of classroom activities.

Children who were assigned to the experimental classrooms were not entirely deprived of the sensory equipment that was associated with the opposite experimental approach. The school had a large learning center that was well equipped with an abundance of audio, visual and combined materials which the children could use at their discretion. Each grade was scheduled to have one hour per week in the Learning Center.

The teachers in conjunction with the principal of the school made the decisions regarding teacher assignments to the experimental and control classrooms. In making these decisions they utilized an approach which included for consideration, teaching experience, the individual teacher's interest in the project, the ability or reluctance to accept new or different ideas regarding teaching techniques, the self-analysis and the possibility of a strong personal unimodal orientation, the thought being that a visually-oriented adult would have difficulty teaching an enriched auditory classroom and vice versa. No problems were encountered in making the teaching assignment.

CHAPTER IV

YEAR 2: INSTRUCTIONAL INTERVENTION

The Population

When school began in the Fall of 1973, the 2nd and 3rd grades were basically the same population as the original group that was tested in 1972 at the beginning of the study. The children were one year older, thus, the present 2nd grader had been in the 1st grade, the present 3rd grader had been in the 2nd grade and so on. However, in any community there are families that move away and those that move in. Thus, there were some additions and subtractions from the original group. The 1st grade, in addition to being in a highly developmental stage perceptually, had many children leave and also many newly entering. Therefore, the entire grade level was retested with the PTB immediately preceding the instructional year. Children in the 2nd and 3rd grades who were new to the school in 1973 were tested with the PTB in order to determine their modality status. In addition, children who had been included in the Neither category at the time of the earlier testing were retested. All children whose modality status was other than the Neither category were then included in the study. All of the children were screened for auditory and visual acuity. Where corrections were necessary, they were made. Eliminated from the study were children who were designated as being in the Neither category at the testing closest to the beginning of the year of instruction. It was not necessary to eliminate any children due to uncorrected vision or hearing, or low IQ. Since no children were deemed to be emotionally disturbed by their teachers, no children were eliminated on that basis.

Because the presenting 1st grade population was too large for the original design of three classrooms at each grade level, it was necessary to eliminate the control classroom and have four experimental classrooms, two auditory and two visual. The 2nd and 3rd grade children were distributed as planned however. Inasmuch as each grade was to be studied separately, it was felt that this would not disrupt the design or interfere with an analysis of the data. At each grade level, then, it appeared that nearly equal distribution of each modality grouping was made among the respective classrooms. The classroom teachers were not informed of the modality status of the students within their classrooms.

Table 3 shows the distribution of the children into classrooms at the beginning of the school year, 1973.

Table 3 goes here

Pre-Posttest Design

Pretest Period - Immediately following the assignment into the classrooms the achievement pretests were administered to the 2nd and 3rd grades. A readiness measure had been administered the previous spring to the present 1st graders when they were completing Kindergarten. All tests

TABLE 3

Distribution of Children by Modality Preference in Grades 1, 2, 3

(Fall 1973)

Grade 1

	Number of Children			
Modality Preference	Classroom 1 (visual)	Classroom 2 (visual)	Classroom 3 (auditory)	Classroom 4 (auditory)
Auditory	7	9	12	9
Visual	9	6	7	10
Either	6	7	4	5
	N=22	N=22	N=23	N=22

Grade 2

	Classroom 1 (visual)	Classroom 2 (auditory)	Classroom 3 (control)
Auditory	7	6	7
Visual	10	9	7
Either	11	11	12
	N=28	N=26	N=26

Grade 3

	Classroom 1 (visual)	Classroom 2 (auditory)	Classroom 3 (control)
Auditory	11	9	8
Visual	6	8	7
Either	8	10	12
	N=24	N=27	N=27

were administered under strict adherence to standard conditions. For the sake of continuity of measurement within the grades, the Metropolitan Readiness (Hildreth, et al., 1969) and Achievement tests (Durost, 1959) were used in measuring change in the 1st graders and the Gates-Mac Ginitie (1965).

Grade 1	Metropolitan Readiness Test Form A, administered to the children in late Spring, 1973, when they were in Kindergarten.
Grade 2	Gates-Mac Ginitie Reading Test Primary B, Form 1 Vocabulary and Comprehension
Grade 3	Gates-Mac Ginitie Reading Test Primary C, Form 1 Vocabulary and Comprehension

In addition to the achievement pretests, the Lorge Thorndike Group Intelligence Tests, Level 1 (1957) were administered to all of the children when they were in the 1st grade. A description of all of the tests that were administered in this study appear in Appendix C.

After the instructional school year was well underway, a field visit was made by the investigators. The classrooms were visited, a staff meeting was held to discuss problems and solutions relative to implementation of the final stages of modality-oriented instruction, and a discussion with the local school board relative to the aims and procedures of the study was conducted.

A multi-media presentation was demonstrated that had been designed and constructed by the teacher-staff of Table Mound School to be used as an aid to clarify the nature of the intervention that of necessity was involved in modality-oriented instruction. This presentation has been used in parent-teacher meetings, shown to other schools in Dubuque and also shown to the administrative and curriculum planning staff of the

Dubuque Schools. A video tape of the experimental classrooms was made during the school year that has been used to vividly clarify the differences in approach between the auditory and visual intervention.

Posttest Period - The posttests were administered during the last two weeks of May, 1974. The tests that were given at that time were:

Grade 1	Metropolitan Achievement Test Primary I Battery, Form A
Grade 2	Gates-Mac Ginitie Reading Test Primary B, Form 2
Grade 3	Gates-Mac Ginitie Reading Test Primary C, Form 2

The hypothesis of this study, then, centered on the effect of matching children's learning preference or style, when such styles were evident, to teaching techniques that were designed to take advantage of the two primary learning modalities. In addition to the children's perceptual status and their pre and post achievement scores, intelligence (henceforth referred to as IQ), age, and sex were variables which were considered appropriate for analysing the experimental effects of this study. All reporting of the data was in terms of the posttest population who met the longitudinal criteria of complete data on all variables. Since each subject's response is represented by more than one score, this study yielded multivariate data (Bock, 1975, p. 23). Analyses of the results of this data utilized the multivariate approach thus bringing to bear all of the interdependent relationships jointly, to test for significance of the findings. The alternative would have been to attempt to derive meaningful results from computation of significance levels on each response variable separately. This is generally unsatisfactory in behavioral research studies because they frequently omit the contribution to the analysis that is made and must be accounted for by such aspects of the data as 1) the correlation of the measures used in the study, 2) structural relationships among dependent variables, 3) the derivation of observed variables (Bock, 1975). In order to retain as much information from the data as possible an analysis of covariance was used. In order to structure relationships between variables and to simplify the data, step-wise (to account for independent variables) and step down (to account for dependent variables), regression analysis was also used in analysing the data of this study.

The main classes for the analyses were Sex, Classroom and Modality Status. The comparisons that were made, their designations and definitions appear in Table 4. this information will clarify the reading of the tables in the following chapters and is placed in this section for easy referral since most of the tables utilizing the contrasts are too large to accommodate the definitions.

TABLE 4

DEFINITION OF SYMBOLIC CONTRASTS FOR ANALYSIS OF COVARIANCE

Contrast		Definition
Sex	=	Boys compared to girls.
Classroom (1)	=	The Auditory Classroom and the Visual Classroom averaged and compared to the Control Classroom. $\left(\frac{\text{Auditory + Visual}}{2} \text{ vs Control}\right)$
Classroom (2)	=	The Auditory Classroom(s) compared to the Visual Classroom(s). Grade 1 classroom comparisons are all (2) because there was no Control room.
Modality Status (1)	=	The Auditory Children and the Visual Children averaged and compared to the Either Children. $\left(\frac{\text{Auditory + Visual}}{2} \text{ vs Control}\right)$
Modality Status (2)	=	The Auditory Children compared to the Visual Children.

Since by definition the Either children did not show a modality preference they were not participants in the hypothesis of the study. An analysis of the performance of the Either children in the two types of experimental classrooms would, in effect, have been an evaluation of teaching methods, phonic emphasis vs. visual emphasis. The literature has reported these studies for years and in addition is the subject of a critical review of the literature by Chall (1967). However, for those readers who are interested, certain data from these groups has been included in this report.

The specific program used was Univariate and Multivariate Analysis of Variance, Covariance and Regression. Program 5.2 National Educational Resources, Inc., 215 Kenwood Ave., Ann Arbor, Mich. 48103, 1972. The results and discussion of the results are reported by each grade separately.

CHAPTER V

GRADE 1 - RESULTS

The design of the study of Grade 1 specified 12 arrangements (cells) from which to view the results. Although a prior study that reported the development and standardization of the earlier versions of the PTB reported no differences between boys and girls (Turaids, Wepman & Morency, 1972), most of the literature reporting studies on early elementary school age children has found sex differences in favor of girls, particularly on language related tasks such as reading and writing (Robinson, 1972). For that reason sex as a main class was included in the design for analysis of this experiment. Thus, the 12 cells were the product of two sex levels, two classroom levels (Auditory and Visual) and three modality status levels (1 Auditory, 1 Visual, 1 Either). The basic data statistics consisting of observed means, standard deviations and correlations (within group) on the Metropolitan Readiness Test (henceforth referred to as the pretest), the Metropolitan Achievement subtests, Word Knowledge, Word Discrimination, and Reading (henceforth referred to as the posttests), chronological age (henceforth referred to as CA) and IQ are presented by groups according to sex, classroom, and modality status in Table 5.

Table 5 goes here

TABLE 5

MEANS, STANDARD DEVIATIONS AND CORRELATIONS (WITHIN GROUP) FOR PRETEST AND POSTTEST SCORES

Grade 1

Group Means (Observed)				Variables					
						Pretest		Posttests	
Sex	Class-room	Mod. Status	N	CA	IQ	Reading Readiness	Word Know.	Word Disc.	Reading
Boys	Auditory	A	4	82.80	117.75	63.25	31.00	29.00	31.00
		V	5	80.80	108.00	63.00	26.00	27.00	21.00
		E	3	78.00	103.00	70.33	23.67	21.67	19.67
	Visual	A	3	78.66	108.67	80.33	30.00	22.33	21.33
		V	9	78.11	105.22	67.11	28.78	28.44	23.00
		E	5	77.40	115.20	65.00	29.00	27.60	20.40
Girls	Auditory	A	8	76.00	109.12	63.00	29.87	28.87	31.50
		V	11	77.18	110.91	72.45	30.64	28.27	31.27
		E	3	78.00	107.00	83.00	31.67	31.66	38.00
	Visual	A	4	78.75	105.25	69.75	27.50	22.00	20.50
		V	7	77.28	110.43	66.14	30.00	29.71	28.28
		E	8	78.12	111.75	70.75	31.60	28.75	31.87
Within Group Standard Deviations				4.71	11.62	13.09	4.34	5.92	11.43

Error Correlation Matrix

CA	1.00					
IQ	-.19	1.00				
Pretest	-.10	.22	1.00			
Word Knowledge	-.05	.23	.41	1.00		
Word Discrimination	-.02	.21	.31	.57	1.00	
Reading	.01	.27	.27	.65	.62	1.00

Note: Pretest, Metropolitan Reading Readiness Test
Posttest, Metropolitan Achievement Test

A = Auditory
V = Visual
E = Either

A joint multivariate analysis of variance (2 x 2 x 3) utilizing a regression analysis and analysis of covariance with six variables was used to test the significance of the above findings when adjusting error variance by the use of pretest, IQ and CA as covariables.

The results of a stepwise regression analysis is shown in Table 6.

Table 6 goes here

The generalized F statistic including all three variables is not significant. In addition, the Multivariate F statistics testing the contribution of CA and IQ are not significant. However, the multivariate statistic shows that a significant portion of the dispersion of scores on all three posttests is accounted for by the pretest. Further clarification of the pre-posttest association is found in Table 7. The standardized coefficients reveal that the posttests are predicted most strongly by the pretest, less strongly by IQ, except in the case of the Reading posttest, and are not predicted by age.

Table 7 goes here

The results of the analysis of covariance with the three covariables eliminated appears in Table 8. The one degree of freedom test shows a nearly significant multivariate F value for only one of the main effects; that of sex. The univariate analysis shows the Reading test to be the most affected by sex (F = 13, p = .01). The study hypothesis, the classroom by modality preference interaction, shows a significant multivariate

Table 8 goes here

TABLE 6

STEPWISE REGRESSION TO ANALYZE CONTRIBUTION OF EACH INDEPENDENT VARIABLE

Grade 1				Univariate Analysis					
	Multivariate Analysis						Step down		Variance Acc't for
Source	df	F	p<	df	F	p<	F	p<	%
Generalized (3 covariates)	9,129	1.59	.13						
Adding CA	3,55	.11	.96						
Word Knowledge				1,57	.14	.71	.14	.71	.25
Word Discrim.					.02	.88	.00	.93	.04
Reading					.00	.94	.17	.68	.00
Adding IQ	3,54	1.59	.20						
Word Knowledge				1,56	2.88	.09	2.88	.09	4.87
Word Discrim.					2.53	.12	.57	.45	4.32
Reading					4.73	.03	1.34	.25	7.79
Adding Pretest (MRR)	3,53	3.16	.03						
Word Knowledge				1,55	9.16	.00	9.17	.00	13.55
Word Discrim.					4.64	.03	.44	.51	7.44
Reading					3.10	.08	.13	.72	4.99

Note: Significant results are underlined.

TABLE 7

REGRESSION COEFFICIENTS (STANDARD ERROR) AND MULTIPLE R INDEPENDENT X DEPENDENT VARIABLES

Grade 1	Independent Variables	Dependent Variables Metropolitan Achievement Tests		
		Word Know.	Word Discrimin.	Reading
Raw Regression Coefficient & (SE)	CA	.0146(.1142)	.0469(.1624)	.1860(.3116)
	DIQ	.0542(.0472)	.0779(.0671)	.2320(.1288)
	MRR	.1254(.0414)	.1267(.0588)	.2005(.1129)
Standardized Regression Coefficient	CA	.0158	.0372	.0766
	DIQ	.1453	.1528	.2359
	MRR	.3782	.3782	.2296
Multiple R		.4322	.3435	.2577

TABLE 8

ANALYSIS OF COVARIANCE (CA, IQ & PRETEST)

Grade 1	Multivariate Analysis			Univariate Analysis of Posttest Scores Metropolitan Achievement Tests						
				Word Knowledge			Word Discrim.		Reading	
Source*	df	F	p<	df	F	p<	F	p<	F	p<
Sex	3,53	2.52	.06	1,55	3.18	.08	.83	.36	7.13	.01
Classroom (2)	3,53	1.34	.27	1,55	.32	.57	.11	.74	1.48	.23
Sex x Classroom	3,53	.24	.86	1,55	.72	.40	.23	.63	.15	.69
Modality Status (1)	3,53	.16	.92	1,55	.08	.78	.04	.85	.08	.78
Modality Status (2)	3,53	1.00	.40	1,55	.10	.38	1.72	.09	.01	.45
Sex x Mod. Status (1)	3,53	.69	.55	1,55	1.71	.20	.94	.34	1.74	.19
Sex x Mod. Pref. (2)	3,53	.80	.50	1,55	1.87	.28	.19	.66	.08	.77
Classroom x Mod. Status (1)	3,53	.99	.40	1,55	1.87	.18	.89	.35	.02	.89
Classroom x Mod. Status (2)	3,53	2.31	.04	1,55	2.4	.06	7.14	.00	2.71	.05
Sex x Classroom x Mod. Status (1)	3,53	.71	.55	1,55	.28	.60	1.50	.22	.01	.95
Sex x Classroom x Mod. Status (2)	3,53	.08	.48	1,55	.13	.72	.01	.93	.03	.87

*See Table 4 for explanation of contrasts. (page 26)
Note: Significant findings are underlined.

F statistic (F = 2.31, p = .04) when comparing the Auditory children to the Visual children. This means that there is a significant difference between the Auditory children and the Visual children in the Auditory and Visual classrooms. The univariate F statistic (also see Table 8) and the corresponding estimated effects shown in Table 9 aid in further interpretation of the results. The univariate F tests show a significant interaction on the Word Discrimination and Reading posttests and a nearly significant F value on the Word Knowledge test. Table 9 shows the estimates of the effects of multivariate analysis. The analysis was set up so that boys were compared to girls, Auditory children to Visual children and Auditory classrooms to Visual classrooms. The result that is of particular interest for interpretation for this study shows the Auditory children compared to the Visual children across the classrooms. The estimated effect of matching the Auditory children in the Auditory classroom resulted in raising their scores 4 points over being mismatched in the Visual classrooms on the Word Knowledge Test, 9.51 points on the Word Discrimination Test and 11.44 points on the Reading Test. In order to interpret the multivariate analysis of the experiment, Table 10 shows the estimated and adjusted means of the significant interaction. A profile of the significant interaction is shown in Figure 2. It is

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Table 9 goes here

Table 10 goes here

Figure 2 goes here

TABLE 9

ESTIMATED EFFECTS ADJUSTED FOR THREE COVARIATES FOR THE DESIGN MODEL

	Estimates and (Standard Error)		
Effect	Word Knowledge	Word Discrimination	Reading
Constant	13.34 (11.32)	6.09 (16.09)	-27.41 (30.89)
Sex	-1.86 (1.08)	-1.99 (1.54)	-7.42 (2.95)
Classroom	-0.59 (1.06)	1.33 (1.51)	4.53 (2.89)
Mod. Status (1)	-0.73 (1.19)	-0.01 (1.69)	0.86 (3.24)
Mod. Status (2)	0.41 (1.24)	-3.20 (1.76)	-0.68 (3.38)
Sex x Classroom	-2.28 (2.18)	-2.01 (3.10)	-3.19 (5.95)
Sex x Mod. Status (1)	-3.41 (2.42)	-3.57 (3.43)	-8.26 (6.59)
Sex x Mod. Status (2)	2.97 (2.53)	-0.56 (3.60)	3.46 (6.91)
Classroom x Mod. Status (1)	-4.04 (2.52)	-4.96 (3.59)	-2.52 (6.89)
Classroom x Mod. Status (2)	4.14 (2.54)	9.51 (3.61)	11.44 (6.94)
Sex x Class x Mod. Status (1)	-2.75 (4.77)	8.12 (6.77)	-1.03 (12.99)
Sex x Class x Mod. Status (2)	1.81 (4.95)	-0.63 (7.04)	2.21 (13.51)

Note: See Table 4 (page 26) for definition of contrasts.

TABLE 10

ESTIMATED COMBINED MEANS INCLUDING COVARIATE ADJUSTMENT OF SIGNIFICANT INTERACTION AND EITHER CHILDREN

Class x Modality Status		Dependent Variables		
		Word Know.	Word Discrim.	Reading
	Auditory	30.44	28.94	31.25
Auditory	Visual	28.32	27.64	26.14
	Either	27.67	26.67	28.83
	Auditory	28.75	22.17	20.92
Visual	Visual	29.39	29.08	25.64
	Either	30.31	28.17	26.14

Note: Dependent Variables: Metropolitan Achievement Tests, IQ, & CA
For completeness of data Either Children are included.

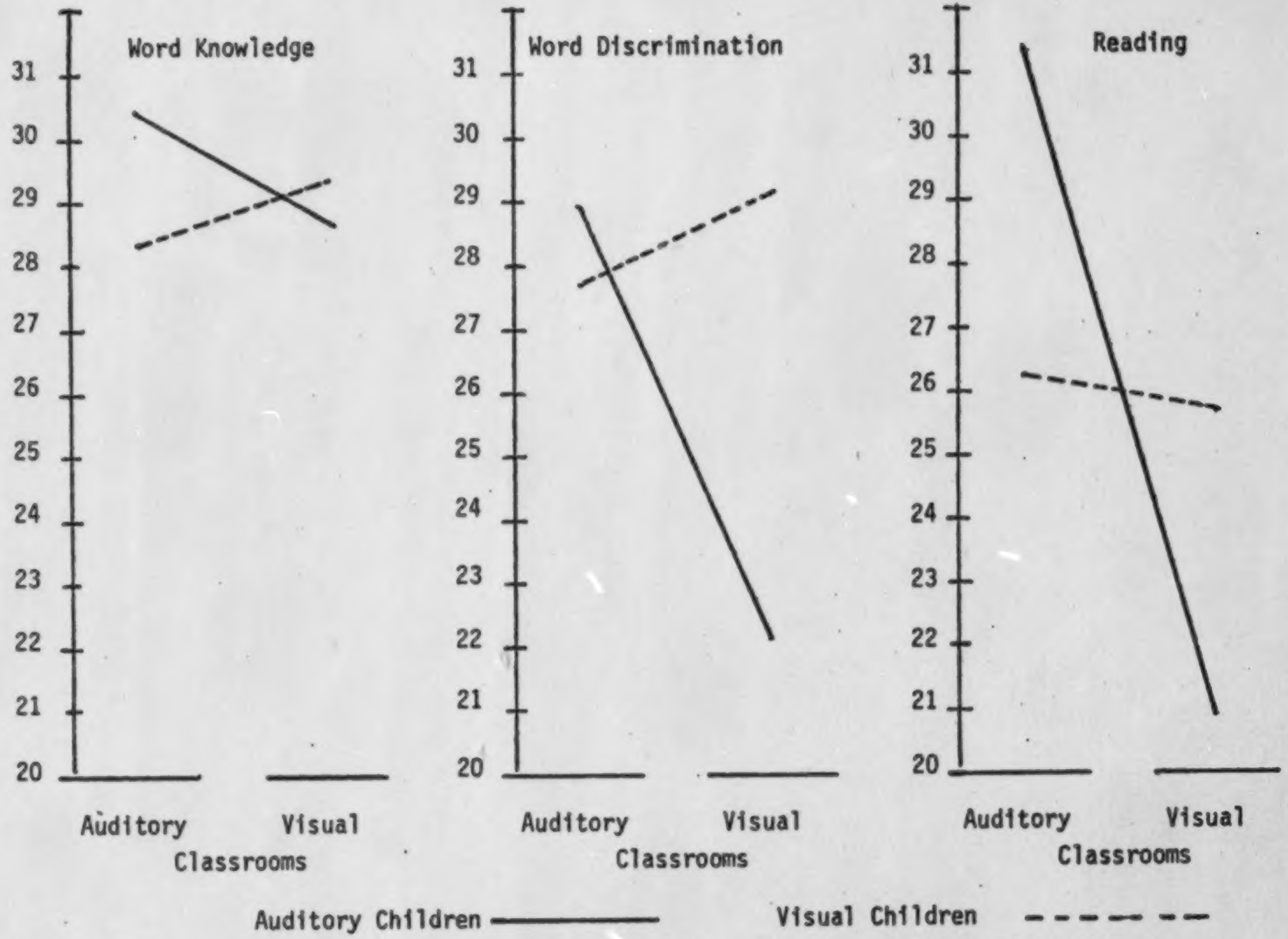


Figure 2--Estimated combined means including covariate adjustment for significant interaction.

clear that the Auditory children scored higher than the Visual children in the Auditory classrooms, and the Visual children scored higher than the Auditory children in the Visual classrooms on all three of the posttests. Relative to the significant sex effect, Table 9 shows also that boys score considerably lower than girls on the Reading Test.

Since the above analysis showed a nearly significant multivariate F statistic on sex (the source for which was primarily on the Reading Test), a reordering of the hypothesis was conducted to seek out the possibility of eliminating sex x class and sex x modality status interactions from the model (Bock, 1975, p. 346). The analysis of covariance based on this reordering is shown in Table 11. Three-way interactions were found to be not significant, however, the main effect was significant, as it was in the previous analysis. The adjusted estimated effects, Table 12, show the direction of the test of significance; girls scored higher than boys on the posttests, however, as in the earlier analysis the Reading Test was found to be the largest contributor. Table 13 shows the combined estimated means that resulted from the reordering of the hypothesis and further confirms the finding that girls scored higher than boys on the posttests, especially on the Reading Test. This finding as was stated earlier, is common to many studies of elementary school age children and

Table 11 goes here

Table 12 goes here

Table 13 goes here

TABLE 11

ANALYSIS OF COVARIANCE WITH ADJUSTMENT FOR IQ AND PRETEST BASED ON REORDERING OF HYPOTHESES

Grade 1	Multivariate Analysis			Univariate Analysis of Posttest Scores Metropolitan Achievement Tests						
				Word Knowledge			Word Discrim.		Reading	
Source	df	F	p<	df	F	p<	F	p<	F	p<
Overall	3,51	3.20	.03	1,53	3.44	.06	.93	.34	.78	.38
Classroom	3,51	1.11	.35	1,53	.02	.89	.60	.44	2.67	.11
Modality Status (1, 2)	6,102	.64	.69	2,53	.42	.66	.64	.53	.04	.96
Class x Modality Status (1)	3,51	.69	.56	1,53	1.62	.21	.53	.47	.04	.83
Class x Modality Status (2)	3,51	2.25	.04	1,53	2.43	.06	6.74	.00	1.96	.08
Sex	3,51	2.80	.04	1,53	5.28	.02	1.33	.25	7.36	.00
Sex x Class	3,51	.08	.97	1,53	.11	.74	.00	.95	.02	.89
Sex x Modality Status (1, 2)	6,102	1.15	.34	2,53	2.59	.08	1.29	.28	2.59	.08
Sex x Class x Modality Status (1, 2)	6,102	.34	.91	2,53	.03	.97	.49	.62	.07	.93

Note: Significant results are underlined.
See Table 4 (page 26) for definition of contrasts.

TABLE 12

ADJUSTED ESTIMATED EFFECTS (TWO COVARIATES ELIMINATED) FITTING ON A MODEL RANK OF NINE

Grade 1	Estimates & (Standard Error)		
Effect	Word Knowledge	Word Discrimination	Reading
Overall	9.83 (5.48)	7.33 (8.11)	-14.61 (15.64)
Sex	-2.21 (0.96)	-1.64 (1.42)	- 7.43 (2.74)
Classroom	-0.06 (0.97)	1.44 (1.43)	4.49 (2.75)
Modality Status (1)	-0.80 (0.90)	-0.42 (1.32)	0.35 (2.56)
Modality Status (2)	0.40 (0.80)	-1.60 (1.18)	0.04 (2.28)
Class x Modality Status (1)	-2.14 (1.82)	-2.38 (2.69)	-0.40 (5.18)
Class x Modality Status (2)	2.60 (1.64)	6.33 (2.42)	6.71 (4.67)

Note: See Table 4 (page 26) for definition of contrasts.

TABLE 13

COMBINED ESTIMATED MEANS BASED ON FITTING MODEL RANK NINE FOR MAIN EFFECTS AND SIGNIFICANT INTERACTION

Grade 1		Variables Posttests		
Groups		Word Knowledge	Word Discrimination	Reading
Sex				
	Boys	27.87	26.23	22.76
	Girls	30.29	28.09	30.47
Classroom				
	Auditory	28.90	27.73	28.58
	Visual	29.26	26.59	24.65
Modality Status				
	Auditory	29.31	25.82	25.78
	Visual	23.67	28.01	25.65
	Control	29.25	27.65	28.41
Class x Modality Status (2)				
Auditory	Auditory	30.11	28.75	29.81
	Visual	28.19	27.01	25.65
	Control	28.39	27.43	30.27
Visual	Auditory	28.51	22.89	21.75
	Visual	29.15	29.01	25.65
	Control	30.11	27.88	26.56

Note: See Table 4 (page 26) for definition of contrasts.

it does not alter the significance of the interaction. The following additional statistics relative to the results of the analysis based on reordering the hypothesis will be found in Appendix C; the Estimated Cell Means, Table 14, and Estimated Combined Means, Standard Deviations Correlations, Table 15.

The hypothesis of the study in this experimental setting is accepted: children who show a preference in learning style score higher when their preference is matched to modality related instructional techniques in reading than when they are mismatched. Figure 3 shows a profile of the significant interaction as a result of the reordering of the hypothesis.

Figure 3 goes here

Discussion

The data from this experiment was systematically analyzed to account for error that might lead to erroneous conclusions. Age, intelligence, pre-experimental achievement standing of the children, sex differences, all were accounted for. The interaction providing us with the evidence to feel confident in accepting the hypothesis was highly significant, overall. Matching children's learning styles when based on their perceptual preference, to modality oriented instructional techniques used to teach reading, resulted in increased achievement over those children who were mismatched in Grade 1. The results of this study are just the opposite of the Robinson (1972) study. She found that achievement was not affected by the matching or mismatching of children who showed modality preferences.

There are several similarities and differences in the two studies, however, that are pertinent for comparing and accounting for the

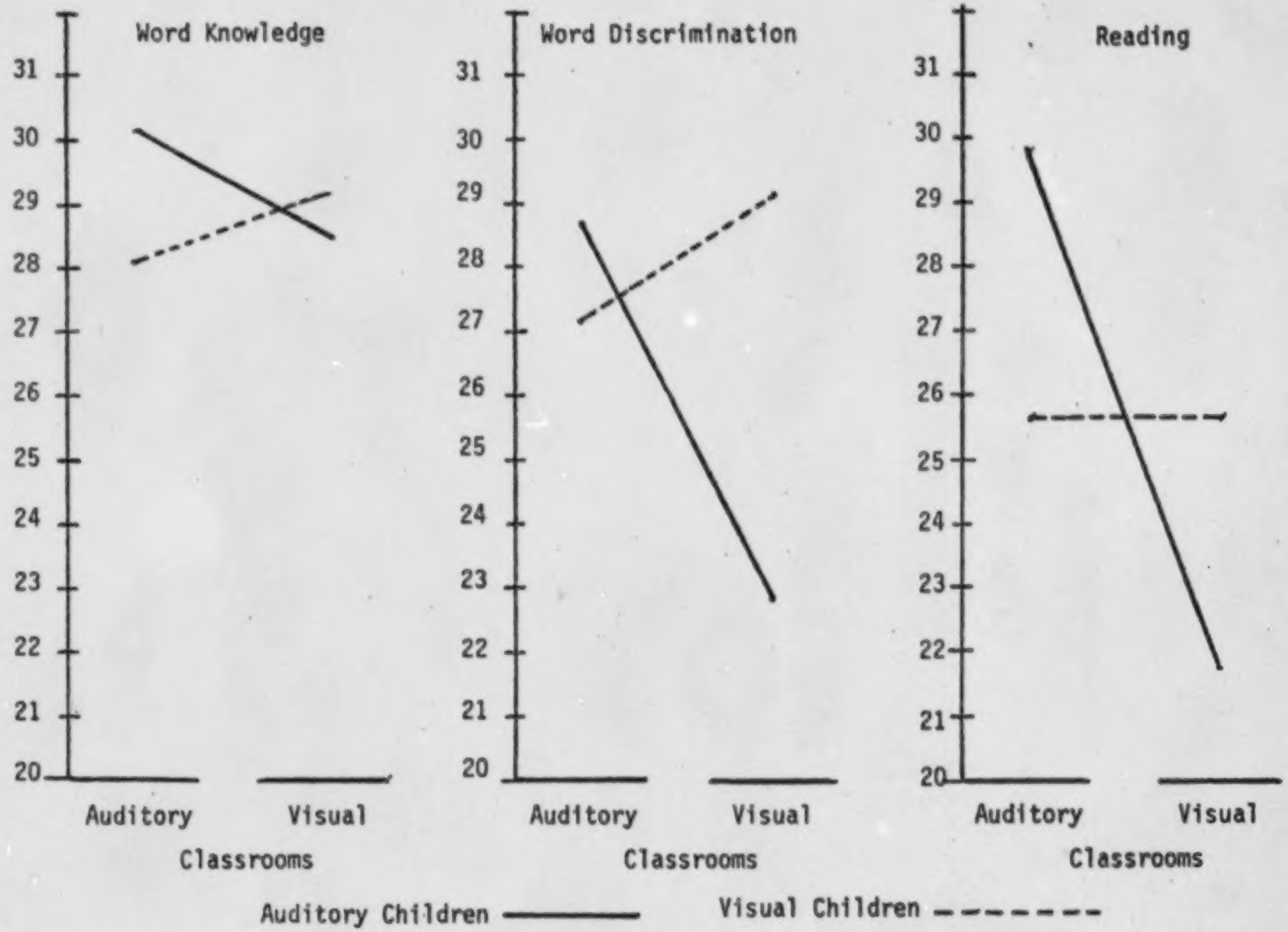


Figure 3--Combined estimated means based on fitting model rank nine for significant interaction.

differences in results. In the first place Robinson selected her modality preference groups using only one auditory test, The Auditory Discrimination Test (Wepman, 1958) and three visual perceptual tests (Goins, 1958). Auditory discrimination alone is not felt to be sufficient to assess all auditory perceptual functioning to the Wepman model. The Goins tests also were designed to tap somewhat different visual abilities from those used in this study, including a visual motor task. The tests used in this study were carefully designed to test the separately identifiable auditory and visual perceptual processing consistent with the Wepman model. Therefore, they do not utilize cross modal functioning nor do they require or incorporate motor functioning beyond pointing or saying a few words. Secondly, the determination of preference appears initially, to be a major point of departure between the two studies. In Robinson's study it was stated that the children were selected on a high-low paradigm; high auditory-low visual, low auditory-high visual, high-high, low-low, etc. However, the division for the groups included the median and a few points on either side, on each of the tests used in her study. In that the children did not have to be at the extremes in performance on the tests, the high-low designation is somewhat misleading.

The children in the present study were selected for preference on the basis of scale score points of difference between the three auditory tests combined and the three visual tests combined. The selection of modality groups in this study is theoretically compatible with the position of the Wepman modality concept and the hypothesis of this study which emphasizes preference for learning rather than strength and/or weakness of perceptual abilities. Of necessity then, by the very nature of the determination formula, the preference groups were higher in their preferred modality than in their non-preferred modality; strength of modality preference based on extremes in performance on the tests was not a design factor in this study nor was it in the Robinson study. Thus, the initial impression that the studies differed on this point is not borne out.

Other factors that may provide some insight into accounting for the different results of the two studies is the method of providing differential instruction. The Robinson study provided for two different schools to supply the different methods of reading instruction whereas this study supplied adaptations to one reading series. The adaptations that were made to the Ginn 360 were far less complicated for the Auditory classroom teachers to effect than for the Visual classroom teachers by the very fact that the Ginn 360 has built into it a heavy loading of phonic instruction to facilitate decoding. The results of this study show that the effect of matching and mismatching of children who show auditory preference is the most dramatic. Chall (1967) in her review of the literature, Bateman (1968) as well as Robinson and others agree with the finding that auditory based or phonic instruction is the most efficient for the most children. However, it is extremely pertinent to find that the children who were found to have a preference for learning visually respond to instruction that utilizes this preference. Visual whole word sight recognition methods of teaching reading have not met with great success for teaching all children. The decoding of new words becomes cumbersomeand limited by visual memory which may well be one of the reasons for the differences in findings of this study and Robinson's. The visual instruction that the Visual classroom teachers provided included techniques utilized in the traditional approach. However, they also utilized word analysis that was similar in method to phonic analysis, but on a visual basis (for samples of lesson plans directly coordinated with teachers' manuals for each classroom type, see Appendix B).

This study did not set out to compare the efficiency of different visual techniques for teaching reading; however, it follows logically that word analysis on a visual similarity and difference basis coordinates with the Ginn 360 Decoding techniques. Thus, when the children who have been found to prefer visual learning are combined with the adaptations of a reading series that emphasizes, in its early levels, the visual decoding of reading material, great strides in achievement can apparently be the outcome for the visual learner rather than the visualness becoming a penalty.

CHAPTER VI

GRADE 2 - RESULTS

The design of the study for Grade 2 specified 18 arrangements (cells) from which to view the data. The 18 cells were the products of two sex levels, three classroom levels (1 Auditory, 1 Visual, 1 Control), and three modality status levels (1 Auditory, 1 Visual, and 1 Either). The basic data statistics consisting of observed means, standard deviations, and correlations (within group) on the Gates-Mac Ginitie Reading Tests, Vocabulary and Comprehension (henceforth referred to as pre or posttests), age (henceforth referred to as CA) and IQ are presented by groups according to the design of the study by sex, classroom and modality status in Table 16. As can be seen there were five cells that had only one observation. It is acknowledged that this is a less than ideal situation on which to base an experiment. In addition, there were two empty cells; there were no observations for Visual boys in the Control classroom nor Auditory girls in the Control classroom. However, estimated means were obtained by reducing the rank of the statistical model and the data was analysed for 16 cells.

Table 16 goes here

A joint multivariate analysis of variance (2 x 3 x 3) utilizing a regression analysis and analysis of covariance with 7 variables was used to test the significance of the above findings when accounting for error variance on IQ, the two pretests and age.

TABLE 16

MEANS, STANDARD DEVIATIONS AND CORRELATIONS (WITHIN GROUP) FOR PRETEST AND POSTTEST SCORES

Grade 2

Group Means (Observed)

				Variables					
						Pretest		Posttest	
Sex	Class-room	Status	N	CA	IQ	Voc.	Comp	Voc.	Comp.
Boys		A	3	75.00	114.33	32.67	26.00	42.00	28.33
	Auditory	V	1	73.00	130.00	33.00	29.00	44.00	25.00
		E	6	85.00	114.83	29.83	17.83	41.67	26.67
		A	1	82.00	116.00	25.00	10.00	31.00	23.00
	Visual	V	1	90.00	116.00	17.00	10.00	42.00	22.00
		E	7	83.28	106.28	19.28	9.71	32.00	24.00
		A	4	76.50	102.00	22.50	12.25	37.75	26.50
	Control	V	0						
		E	9	81.44	107.33	25.78	13.55	33.77	23.33
Girls		A	2	77.50	97.50	30.00	19.00	40.00	26.50
	Auditory	V	4	82.25	112.50	29.25	22.50	40.50	27.00
		E	5	79.20	121.40	33.80	24.80	40.20	28.80
		A	3	77.67	106.00	20.67	11.67	31.00	25.33
	Visual	V	1	73.00	83.00	19.00	9.00	31.00	23.00
		E	3	80.67	109.67	25.00	14.67	36.33	27.00
		A	0						
	Control	V	1	72.00	108.00	43.00	19.00	46.00	32.00
		E	5	81.00	111.00	27.80	17.40	34.69	24.40
Within Group Standard Deviations				6.38	8.50	7.37	5.62	5.96	5.48

Error Correlation Matrix

CA	1.00					
IQ	-.25	1.00				
Pre Voc.	.14	.37	1.00			
Pre Comp.	.00	.19	.66	1.00		
Post Voc.	.08	.13	.52	.38	1.00	
Post Comp.	.11	.32	.44	.47	.54	1.00

Note: Pre and Posttests, Gates MacGinities Reading Tests

A = Auditory
V = Visual
E = Either

The results of a stepwise regression analysis is shown in Table 17.

Table 17 goes here

The generalized F statistic including all four covariables is highly significant (F = 2.66, p = .01). Thus, the inclusion of the covariables in the analysis clearly results in a significant reduction of error dispersion. The multivariate F statistic for adding the pre Vocabulary test is also highly significant (F = 6.76, p = .003). Moreover, the univariate F statistic shows reduction of error is significant for the response variables separately. Although the multivariate F statistic for adding IQ is not significant the univariate statistics show significant reduction in error in the analysis of the post Comprehension subtest. The regression coefficients appear in Table 18. The standardized coefficients reveal that the posttest Vocabulary test is most strongly predicted by the pre Comprehension test.

Table 18 goes here

The analysis of covariance, with the effect of the four variables accounted for is shown in Table 19. There is but one significant multivariate F statistic; Classroom (2) which is the comparison between the Auditory and Visual classrooms (F = 3.24, p = .02). Table 20 shows the

Table 19 goes here

Table 20 goes here

TABLE 17

STEPWISE REGRESSION TO ANALYSE CONTRIBUTION OF EACH INDEPENDENT VARIABLE

Grade 2	Multivariate Analysis			Univariate Analysis					
Source	df	F	p<	df	F	p<	Step down F	p<	Variance Acc't for %
Generalized (4 Covariates)	8,70	2.66	.01						
Adding IQ	2,38	2.35	.11						
Vocabulary				1,38	.71	.40	.71	.40	1.79
Comprehension					4.69	.03	3.93	.05	10.73
Adding Pre Voc	2,37	6.76	.00						
Vocabulary				1,38	13.14	.00	13.14	.00	25.23
Comprehension					5.56	.02	.54	.47	11.40
Adding Pre Comp	2,36	1.72	.19						
Vocabulary				1,37	.13	.71	.13	.71	.26
Comprehension					3.30	.08	3.29	.08	6.38
Adding CA	2,35	.22	.19						
Vocabulary				1,36	.01	.97	.01	.97	.01
Comprehension					.39	.54	.44	.51	.76

Note: Significant results are underlined.

TABLE 18

REGRESSION COEFFICIENTS (STANDARD ERROR) & MULTIPLE R: INDEPENDENT X DEPENDENT VARIABLES

Grade 2		Gates Mac Ginitie Posttests	
		Vocabulary	Comprehension
Raw Regression Coefficients & (SE)	IQ	-.0469 (.1150)	.1145 (.1041)
	Pre Vocabulary	.4023 (.1698)	.1288 (.1537)
	Pre Comprehension	.0714 (.2031)	.3096 (.1840)
	CA	.0057 (.1442)	.0814 (.1306)
Standardized Regression Coefficients & (SE)	IQ	-.0669	.1778
	Pre Vocabulary	.4975	.1735
	Pre Comprehension	.0673	.3179
	CA	.0061	-.0949
Multiple R		.5224	.5411

TABLE 19

ANALYSIS OF COVARIANCE (IQ, 2 PRETESTS, CA)

Grade 2 Source	Multivariate Analysis (df 2,35) F	p<	Univariate Analysis Gates Reading Achievement Post Test (df 1,36) Voc F	Voc p<	Comp F	Comp p<
Constant	1.289	.2883	2.6473	.1125	.4261	.5181
Sex	.1631	.8502	.3128	.5795	.0121	.9129
Classroom (1)	.9722	.3883	1.7412	.1953	.0152	.9027
Classroom (2)	3.2476	.0254	1.9638	.0843	1.7821	.0901
Modality Status (1)	.4105	.6665	.8403	.3655	.2120	.6480
Modality Status (2)	1.1141	.1698	.8561	.1805	.4484	.2532
Sex X Classroom (1)	.3305	.3604	.1369	.3562	.2492	.3104
Sex X Classroom (2)	.0840	.4598	.1329	.3588	.0004	.4924
Sex X Modality Status (1)	1.2767	.2917	.9545	.3351	.5359	.4689
Sex X Modality Status (2)	1.1096	.1705	.2488	.3105	1.1274	.1477
Classroom (1) X Modality Status (1)	1.6928	.1988	2.4235	.1283	2.5871	.1165
Classroom (1) X Modality Status (2)	.0452	.4779	.0510	.4113	.0801	.3894
Classroom (2) X Modality Status (1)	.0301	.4582	.0444	.4172	.0007	.4895
Classroom (2) X Modality Status (2)	.2616	.3857	.2707	.3030	.4085	.2463
Sex X Classroom (2) X Mod. Status (1)	.4560	.3188	.9381	.1696	.1836	.3354
Sex X Classroom (2) X Mod. Status (2)	.4814	.3110	.9789	.1645	.1150	.3682

Note: Significant results are underlined.

TABLE 20

ADJUSTED ESTIMATED EFFECTS FOR THE DESIGN MODEL

Grade 2	Estimates & (Standard Errors)	
	Gates Mac Ginitie Reading Achievement Test	
Effect	Vocabulary	Comprehension
Constant	31.87 (18.61)	11.27 (16.86)
Sex	2.66 (2.71)	-2.50 (2.45)
Classroom (1)	1.02 (2.82)	1.57 (2.55)
Classroom (2)	2.83 (2.97)	-3.38 (2.69)
Mod. Status (1)	-2.59 (2.02)	- .34 (1.83)
Mod. Status (2)	-3.97 (3.55)	2.56 (3.21)
Sex x Classroom (1)	- .64 (3.94	- .00 (3.56)
Sex x Classroom (2)	-1.21 (4.79)	- .50 (4.34)
Sex x Mod. Status (1)	-3.20 (4.87)	5.02 (4.41)
Sex x Mod. status (2)	-7.80 (6.51)	2.36 (5.90)
Class (1) x Mod. Status (1)	-6.61 (4.32)	-5.32 (3.92)
Class (1) x Mod. Status (2)	1.34 (9.13)	2.85 (8.27)
Class (2) x Mod. Status (1)	- .19 (4.11)	.64 (3.72)
Class (2) x Mod. Status (2)	5.17 (6.90)	4.86 (6.25)
Sex x Class (2) x Mod. Status (1)	9.49 (8.59)	3.68 (7.78)
Sex x Class (2) x Mod. Status (2)	13.42 (13.56)	4.17 (12.28)

Note: Refer to Table 4 (page 26) for definition of contrasts.

adjusted estimated effects. The multivariate analysis of variance of twelve dependent variables is shown in Table 21. The significant F

Table 21 goes here

statistics have been underlined for ease in reading the table. The three classrooms were highly significantly different on IQ and also on the pretests, which of course is not the expectation of the experimental situation; on the pretests, there should be no significant differences between the classrooms on variables that may contribute to posttest achievement. Table 22 shows the combined observed cell means of the significant differences of the factors on the dependent variables. To simplify the interpretation of Table 22, Figure 4 shows the profile of the observed Pre and Posttests mean scores of the Auditory and Visual and Control classrooms. The mean of the Control classroom which is not a part of the significant findings but is included to provide complete

TABLE 22

GROUP MEANS (OBSERVED) FOR SIGNIFICANT DIFFERENCES BETWEEN THE AUDITORY AND VISUAL CLASSROOMS

	Classrooms	
Variables	Auditory	Visual
IQ	115.0	106.6
Pre Vocabulary	31.24	20.81
Post Vocabulary	41.10	33.12
Pre Comprehension	22.19	11.00
Post Comprehension	27.38	24.56

Note: Pre and Posttests: Gates Mac Ginitie Reading Tests

Figure 4 goes here

TABLE 21

MULTIVARIATE ANALYSIS OF VARIANCE OF SEX, CLASSROOM (2) MODALITY STATUS (2) ON 12 VARIABLES

Grade 2	Sex F_o.(12,29) = 1.31, p = .26		Classroom (2) F_o.(12,29) = 3.84, p = .00		Modality Status (2) F_o.(12,29) = 4.71, p = .00	
			Univariate Analysis of Covariance			
Variables	F (df 1,40)	p<	F (df 1,40)	p<	F (df 240)	p<
IQ	.04	.84	8.79	.00	.52	.47
Gates Pre Vocabulary	2.61	.11	17.26	.00	.02	.88
Gates Pre Comprehension	6.26	.01	34.22	.00	.04	.83
Gates Post Vocabulary	.17	.68	16.18	.00	.79	.38
Gates Post Comprehension	1.25	.27	2.20	.14	.24	.63
CA	1.47	.23	.08	.77	1.11	.30
Auditory Discrimination	.00	.96	.02	.88	1.06	.31
Auditory Memory	.08	.77	.08	.78	2.71	.11
Auditory Sequential Memory	1.15	.29	.01	.90	3.09	.09
Visual Discrimination	.48	.49	.09	.76	8.39	.00
Visual Memory	.92	.17	.01	.90	9.54	.00
Visual Orientation Memory	.53	.22	.38	.53	17.41	.00

Note: Refer to Table 4 (p. 26) for definition of contrasts.
Significant results are underlined.

information on this factor in Grade 2, seems to fall in between the experimental classrooms. The Visual class stands out with respect to its low mean on the pretests and on the Vocabulary posttest in comparison to the Auditory classroom. This finding also shows that the Visual classroom gained more ground on the Comprehension test than the Auditory classroom even though the observed means show that the Auditory class mean is slightly higher. Actually, the estimated posttest means on which the above significant findings were based are quite different from the observed means. The estimated means on the posttests for the two classrooms that are involved in the significant contrast are seen on Table 23

TABLE 23

GROUP MEANS (ESTIMATED) FOR SIGNIFICANT DIFFERENCES BETWEEN THE AUDITORY AND VISUAL CLASSROOMS

	Classrooms	
Variables	Auditory	Visual
Post Vocabulary	39.62	36.79
Post Comprehension	23.90	27.28

and displayed in profile form in Figure 5. This type of effect results

Figure 5 goes here

when the analysis of covariation is applied in an experiment where sampling errors had occurred. It appears that the random assignment of the children to the classroom did not result in similar classes, most likely because of the small n in each class. In addition, the attrition of the longitudinal population did not contribute to the experimental conditions. The use of covariates in an experiment such as this is to reduce the within group

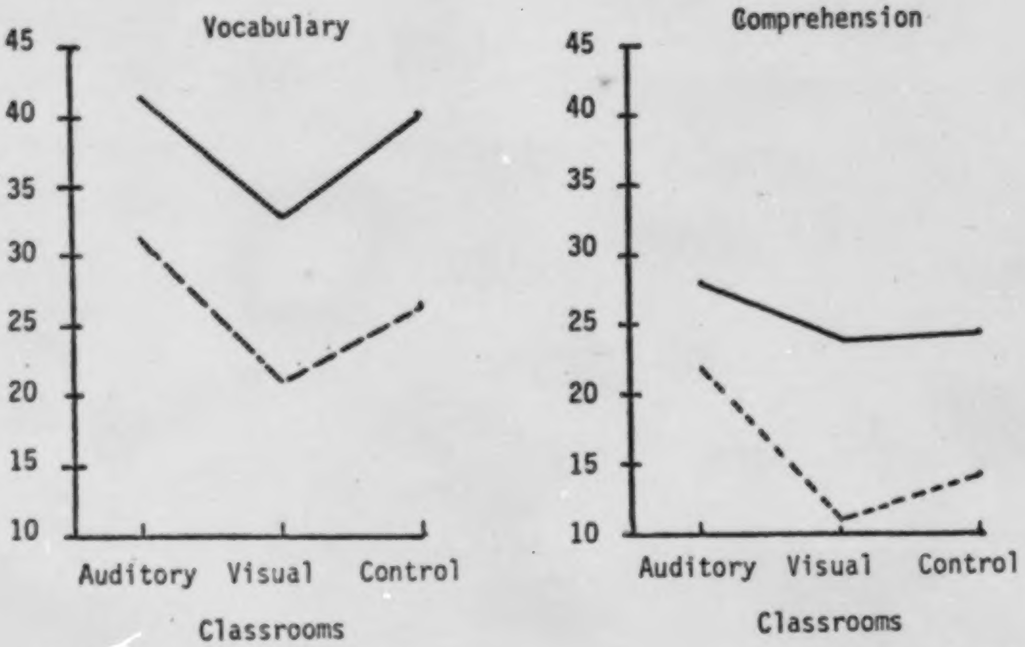


Figure 4--Observed combined means (raw scores) of the Gates Mac-Ginitie Reading Tests for grade 2 for significant interaction.

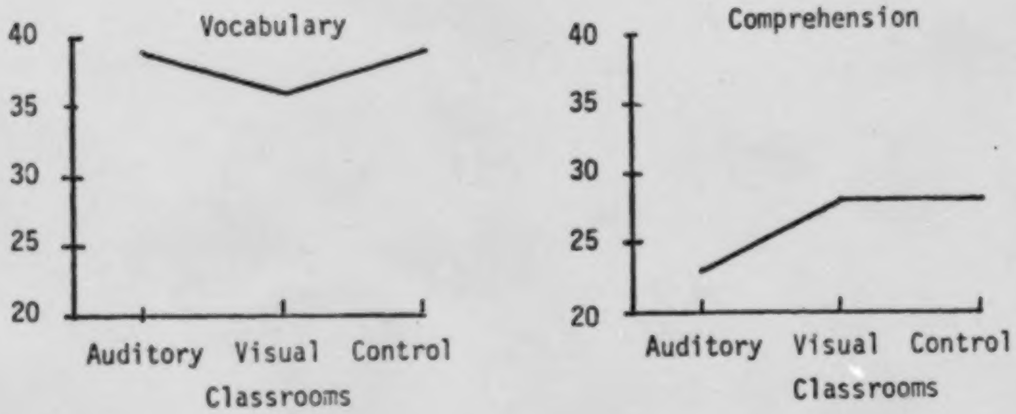


Figure 5--Estimated combined means (raw scores) with four covariates.

Note: Pretest - - - - - - Posttest ————

differences. However, in this analysis the effect it had was to decrease between group variation because of the differences in mean pretest scores between classrooms.

Because of the unacceptable experimental conditions a valid test of the study hypothesis was not possible.

Discussion

It was disappointing that the combination of factors including the small n, the sampling difficulties, and also the possible effect (but not one that was directly tested) that a year of prior classroom experience may have had on this group of children, did not provide Grade 2 with good experimental conditions. Actually, because of the fact that there were five cells with only one observation (e.g., one boy with a visual preference in the Auditory classroom, see Table 16) any acceptance or rejection of the experimental hypothesis would have been irresponsible.

It is often a puzzle to researchers how, when precaution is taken, random assignment is not attained and thus fails so miserably to provide the necessary criterion of normal distribution among the groups of a study. When the normal distribution is maintained in an experimental set-up such as this one, it is not necessary to control for teacher effect. Therefore, although it would have been desirable to have that control in the present circumstances of differences in classrooms, we did not.

A closer look at the 2nd grade will not provide an answer to the problem that there was not a normal distribution in the grade between the classrooms nor will it make up for other apparent shortcomings, however, it may be of interest to understand this particular 2nd grade. The children in Grade 2 had had a year of schooling prior to the experimental year, using a different basal reading series. Table 24 shows means of percentile ranks for the 2nd grade pre and post achievement tests. As a whole the three classes were at the 62nd percentile according to the national norms on both of the pretests. This meant that 62% of the national population scored lower than they did at the beginning of the year. However, the Auditory class was at the 76th percentile, the Visual class at the 42nd percentile and the Control classroom at the 62nd percentile, on the pre Vocabulary test, and at the 79th, 38th and 54th percentile respectively on the pre Comprehension test. On the Vocabulary posttest the Auditory class~~room~~ was still at the 76th percentile, the Visual classroom was at the 46th percentile, an advance of four points, and the Control class losing six points, was at the 54th percentile. On the Comprehension posttest, the Auditory classroom was at the 66th percentile, a loss of 12 points, the Visual class at the 50th, gained 12 points, and the Control class at the 50th percentile, a loss of four points.

TABLE 24

PERCENTILE* RANKS OF OBSERVED MEANS ON THE PRE & POST TESTS FOR THE THREE CLASSROOMS

	Vocabulary			Comprehension		
Classrooms	pre	post	change	pre	post	change
Overall	62	62	0	62	62	0
Auditory	76	76	0	79	66	-7
Visual	42	46	+4	38	50	+12
Control	62	54	-6	54	50	-4

*Gates Mac Ginitie National Norms

Stated in different terms, Table 25, shows the same data as Table 22

TABLE 25

GRADE EQUIVALENTS* OF OBSERVED MEANS ON THE PRE & POST TESTS FOR THE THREE CLASSROOMS

	Vocabulary			Comprehension		
Classrooms	pre	post	change	pre	post	change
Overall	2.4	2.8	+.4	2.2	3.4	+1.2
Auditory	2.6	4.1	+1.7	2.7	3.7	+1.0
Visual	1.7	2.8	+1.1	1.6	3.1	+1.7
Control	2.3	3.1	+1.8	1.9	3.1	+1.9

*Gates-Mac Ginitie National Norms

but presented in grade equivalents. At the beginning of Grade 2, the Auditory classroom was above grade level (2.6) on the Vocabulary test, the Visual classroom was below (1.7) and the Control slightly above grade level (2.3). At the end of the year the Auditory classroom had gained 1.7 in grade level, the Visual class had gained 1.1 in grade level, and the Control 1.8. On the Comprehension test the greatest gain over the year by grade level was made by the Control classroom. However, the Visual classroom had gained 1.7 in grade level and the Auditory room 1.0.

To further interpret the analysis of data from the study, it is of interest at this point to refer to the means of the PTB (raw scores) of the 2nd grade shown in Table 26. It will be recalled that the PTB was administered a year before the year of instructional intervention. The children who were new to the school the year the study began were added to the study. They were administered the PTB immediately prior to the beginning of the instructional year. Regardless of variation in the times that the PTB was given and also the fact that some of the

TABLE 26

GROUP MEANS (OBSERVED) OF THE THREE CLASSROOMS OF GRADE 2 ON THE SIX PERCEPTUAL TESTS

Variables	Classrooms Auditory	Visual	Control
Auditory Discrimination	22.52	22.81	22.52
Auditory Memory	28.62	28.06	28.62
Auditory Sequential Memory	24.76	25.44	24.76
Visual Discrimination	14.10	13.81	12.74
Visual Memory	10.33	10.19	9.78
Visual Orientation Memory	12.38	11.81	11.21

children were six and others seven years old, the PTB scores on all three of the classrooms were quite low and there was no difference between the classrooms. When the formula for determining the preference of the children (see page 12) is applied to the means of the 2nd grade and the arbitrary points of difference determined using the six year old scale scores, the class is a "0" scaled score on the combined auditory tests and a "+1" on the combined visual tests. This indicates that if all of the children were six years old they would be considered rather low ranking Eithers. If the formula is applied to the grade as a whole on the seven year old scale score norms, the class would be considered Neithers as a group, because four of the PTB tests would have a minus scale score rating. The statistical analysis of this aspect of the data is beyond the scope of this study, however, it is evident that the entire 2nd grade was low perceptually. The Auditory class had significantly higher IQs than the Visual class, they had achieved at a higher level the year before and maintained the level, and apparently were able to achieve adequate adaptations to the teaching techniques that this experimental year offered to maintain average gain on the achievement tests. The Visual class, on the other hand, was lower in IQ significantly as well as low in perceptual ability; thus, it is tempting to conclude that the Visual children apparently responded to the combined effect of instruction in reading as taught by the Ginn 360 and the instructional intervention that was designed to augment that decoding series with special visual decoding techniques.

Although they were considerably below grade level at the beginning of the year, the Visual class reached slightly above grade level achievement, thereby realizing greater gains by the end of the school year than the other two classes. As we discussed earlier, because the design of this study did not call for it, we did not have teacher effect controlled, therefore, we do not have a definitive answer from the data at hand to offer a clear conclusion relative to why this happened. The finding, however, does suggest that there may be strong advantages to Visual instruction of the type used in this study for visually minded children and children who have had difficulty learning to read. This finding is reinforced and becomes very important to the modality concept when coupled with the results of the 1st grade that accepted the hypothesis relative to the superiority of visual instruction with Visual children. The literature is filled with confirmation that auditory decoding (phonics) is the most efficient method of teaching reading for most children (Chall, 1967); those children being the ones who can learn by ear. However, there seems to be a percentage of children in every classroom who cannot learn well by ear. These children seem to learn significantly better with a visual emphasis in decoding techniques. This finding has emerged as one of the primary findings of this study.

CHAPTER VII

GRADE 3 - RESULTS

The design of the study for Grade 3 was exactly the same as for Grade 2. The basic data statistics consisting of observed means, standard deviations and correlations (within group) on the Gates-Mac Ginitie Reading Tests, Vocabulary and Comprehension, Form 1 (henceforth referred to as pre and posttests), chronological age (henceforth referred to as CA), and IQ are presented by groups according to the design of the study by sex, classroom and modality status in Table 27.

Table 27 goes here

A joint multivariate analysis of variance (2 x 3 x 3) utilizing a regression analysis and analysis of covariance with six variables was used to test the significance of the above findings when accounting for error variance on the two pretests, age and IQ.

The results of a stepwise regression analysis is shown in Table 28

Table 28 goes here

with scores of the two pretests, CA and IQ as covariables. The generalized F statistic including all four covariables is highly significant (F = 6.48, p = .01). The inclusion of the covariable in the anlysis clearly results in a significant reduction of error dispersion. The

TABLE 27

MEANS, STANDARD DEVIATIONS AND CORRELATIONS (WITHIN GROUP) FOR PRETEST AND POSTTEST SCORES

Grade 3

Group Means (Observed)				Variables					
						Pretest		Posttest	
Sex	Class-room	Status	N	CA	IQ	Voc.	Comp.	Voc.	Comp.
Boys		A	4	89.75	115.00	29.25	24.75	39.50	37.25
	Auditory	V	3	102.33	112.00	25.66	22.66	37.00	42.00
		E	5	91.40	106.20	25.00	18.80	36.60	37.40
		A	3	94.00	105.00	34.33	33.00	43.66	38.33
	Visual	V	2	89.00	124.00	25.50	20.00	31.50	30.50
		E	2	90.00	107.00	40.00	32.50	46.00	45.00
		A	1	86.00	116.00	25.00	15.00	23.00	25.00
	Control	V	1	87.00	111.00	28.00	15.00	42.00	24.00
		E	2	96.50	102.00	27.00	10.50	35.00	27.50
Girls		A	5	94.20	108.80	32.20	27.00	43.40	41.60
	Auditory	V	1	84.00	115.00	38.00	27.00	40.00	40.00
		E	4	94.75	107.00	30.75	30.25	35.75	38.00
		A	7	90.28	112.14	31.14	30.14	39.42	36.42
	Visual	V	2	86.00	106.50	41.00	30.50	44.50	39.50
		E	3	92.33	107.00	33.33	32.66	43.66	43.00
		A	4	95.25	106.50	27.50	21.25	32.50	27.50
	Control	V	3	92.66	105.33	34.00	26.33	40.33	37.33
		E	3	88.00	114.00	28.00	21.00	33.66	24.00
Within Group Standard Deviations				6.12	10.11	8.06	7.61	6.23	7.83

Error Correlation Matrix

CA	1.00					
IQ		1.00				
Pre Voc.	-0.39	0.29	1.00			
Pre Comp.	-0.14	0.31	0.73	1.00		
Post Voc.	-0.28	0.27	0.75	0.53	1.00	
Post Comp.	0.01	0.25	0.61	0.63	0.71	1.00

Note: Pre and Posttests, Gates MacGinities Reading Tests

A = Auditory
V = Visual
E = Either

TABLE 28

STEPWISE REGRESSION TO ANALYZE CONTRIBUTION OF EACH INDEPENDENT VARIABLE

Grade 3	Multivariate Analysis			Univariate Analysis					
Source	df	F	p<	df	F	p<	Step down F	p<	Variance Acc't for %
Generalized (4 covariates)	8,64	6.48	.01						
Adding IQ	2,35	1.58	.22						
Vocabulary				1,36	2.93	.09	2.92	.09	7.52
Comprehension					2.56	.12	.30	.59	5.64
Adding Gates Pre Voc	2,34	20.35	.01						
Vocabulary				1,35	39.88	.00	39.88	.00	49.25
Comprehension					18.33	.00	.92	.34	32.09
Adding Gates Pre Comp	2,33	3.39	.04						
Vocabulary				1,34	.05	.82	.05	.82	.07
Comprehension					4.48	.04	.72	.01	7.14
Adding CA	2,33	2.16	.13						
Vocabulary				1,33	.06	.81	.06	.81	.08
Comprehension					3.59	.07	4.25	.05	5.31

*Note: Significant results are underlined.

multivariate F statistic for adding IQ and CA was not significant nor are the univariate statistics. The multivariate F statistics for adding both of the pretests is significant; the F statistic (20.35) for adding the pre Vocabulary test is significant at the .01 level and the F statistic (3.39) for adding pre Comprehension is significant at the .04 level. As can be seen in Table 28, most of the variance is accounted for by the pre Vocabulary test. The regression coefficients appear in Table 29. The standardized coefficients reveal that the post Vocabulary test is predicted primarily by the pre Vocabulary test and the post Comprehension is predicted by both the pre Vocabulary and pre Comprehension and to a smaller degree by CA.

Table 29 goes here

The analysis of covariance, adjusting for the effect of IQ, CA, and the two pretests is presented in Table 30. There is a three-way multivariate significant interaction, Sex by Classroom (1) by Modality (2) (F = 4.15, p = .01). The univariate statistic shows that the significance is primarily on the Vocabulary posttest.

Table 30 goes here

Referring once again to Table 27, it is possible to observe the wide variation in scores on the Vocabulary posttest made by boys and girls according to their modality status and classroom assignment. In an attempt to aid in interpreting the direction of the three-way interaction, Figures 6 and 7 provide visualization from two different perspectives. The combined three-way interaction confounds the testing of the study hypothesis and all of the other hypotheses that precede it in

TABLE 29

Regression Coefficients, (Standard Error), and Multiple R
Independent x Dependent Variables

Achievement Year 1973-74
Grade 3

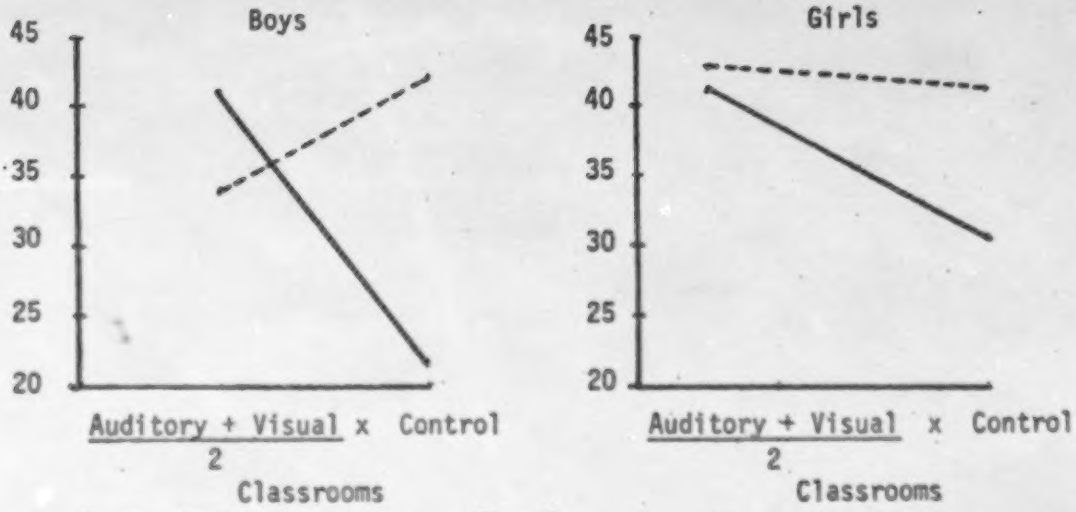
	Independent Variables	Dependent Variables			
		Gates Voc. Post		Gates Comp Post	
Raw Regression Coefficient & (SE)	DIQ	.0404	(.0749)	.0510	(.1003)
	Gates Pre Voc	.6034	(.1437)	.4637	(.1924)
	Gates Pre Comp	-.0403	(.1430)	.3170	(.1915)
	CA	.0321	(.1310)	.3324	(.1754)
Standardized Regression Coefficient	DIQ	.0656		.0647	
	Gates Pre Voc	.7807		.4773	
	Gates Pre Comp	.0493		.3078	
	CA	.0316		.2600	
Multiple R		.7545		.7154	

TABLE 30

ANALYSIS OF COVARIANCE (IQ, PRETESTS, CA)

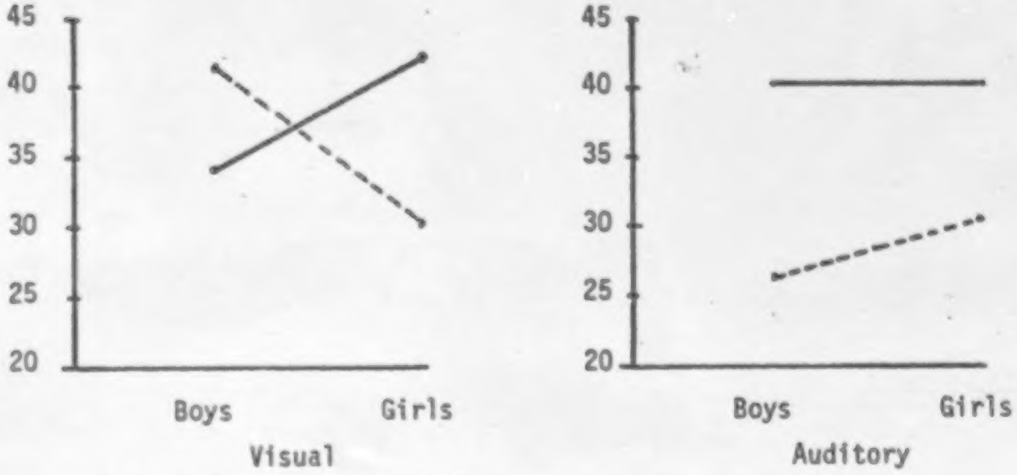
Grade 3	Multivariate Analysis (df 2,32)		Univariate Analysis Gates Reading Achievement Post Test (df 1,33)			
			Voc		Comp	
Source	F	p<	F	p<	F	p<
Constant	1.9208	.1631	.7455	.3942	1.0870	.3047
Sex	1.2853	.1905	.1086	.7439	2.30	.1381
Classroom (1)	4.5559	.0182	.5441	.0260	8.6076	.0061
Classroom (2)	2.1148	.0650	.0401	.8426	2.6933	.0550
Modality Status (1)	.1829	.8338	.0827	.7755	.0906	.7651
Modality Status (2)	.6905	.2543	.0516	.4108	.7449	.1872
Sex X Classroom (1)	.0021	.9979	.0000	.9983	.0030	.9570
Sex X Classroom (2)	.3893	.3403	.1636	.3442	.7946	.1681
Sex X Modality Status (1)	.6886	.5096	.4250	.5190	1.4202	.2419
Sex X Modality Status (2)	.0239	.9764	.0367	.8492	.0393	.8441
Classroom (1) X Modality Status (1)	.5697	.5714	.0693	.7940	.5514	.4630
Classroom (1) X Modality Status (2)	5.1497	.0055	9.1968	.0023	.4022	.2552
Classroom (2) X Modality Status (1)	1.9420	.0800	3.8114	.0255	2.0318	.0817
Classroom (2) X Modality Status (2)	.0098	.9903	.0005	.4915	.0166	.4533
Sex X Classroom (1) X Mod. Status (1)	.0625	.9396	.128[illegible]	.7222	.0421	.8388
Sex X Classroom (1) X Mod. Status (2)	4.1507	.0125	3.587	.0453	1.0586	.1555

Note: Significant results are underlined.
See Table 4 (page 26) for definition of contrasts.



Note: Auditory Visual

Figure 6--Observed combined means (raw scores) on the post Vocabulary Test for the significant three-way interaction. View 1.



Note: Auditory + Visual / 2 Classrooms ————————
Control Classroom - - - - - - - - - -

Figure 7--Observed combined means (raw scores) on the post Vocabulary Test for the significant three-way interaction. View 2.

the analysis. The following additional statistical information will be found in the appendix: Estimates of the Effects Adjusted for Covariates, Table 31; Estimated Combined Means Including Covariate Adjustment, Table 32.

Discussion

It appears that the experiment in Grade 3 as well as Grade 2 suffered a sampling error; the initial random assignment of the children into classrooms did not result in similar classes. This difficulty was probably due initially to a small n, for the attrition combined with the deletion of some subjects due to incomplete data left the population quite unequal. For example, the three-way interaction seemed to be heavily based on one Auditory boy and one Visual boy in the Control classroom. The validity of the entire 3rd grade experiment seems unreliable when it is observed that the Auditory boy in the Control classroom regressed in achievement score on his post Vocabulary test. It is, therefore, impossible to draw any conclusions regarding the hypothesis of the study from Grade 3.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The hypothetical construct of this study was based on the developmental theory of perceptual functioning (Wepman, 1964, 1968). The postulating handicapping effect on learning that a definite lag in development of one modality may have on a child's ability to learn to read that evolved from this model was extended to encompass the normal distribution of individual differences in perceptual development that is found in young children. The hypothesis of the study was: Instruction in reading, when matched with the unimodal learning styles of the children who have a modality preference will result in higher achievement scores than those children whose unimodal learning styles are mismatched to modality related instructional techniques. The subjects who were studied were in the 1st, 2nd and 3rd grades of one elementary school. Their perceptual level of development was assessed by three auditory and three visual tests that had been designed earlier to explicitly correspond by definition to the model. A trained team of local people (former teachers, etc.) individually administered the tests.

The modality status of the children was determined by applying a formula to the scaled scores of the perceptual tests. The formula provided a method of measuring the level of development of the auditory compared to the visual modality. The decision was arbitrary relative to the definition of the modality preference for this study and thus became an integral part of the experiment.

The participating school had adopted the Ginn 360 Reading series for use in the first three grades. The modality related adaptations to increase the initial auditory or visual presentations of each objective in the lesson plans of the Ginn 360 were mapped out, materials constructed and classroom environments designed by the participating teachers during a summer workshop just prior to the instructional school year. The teacher assignments for the three grades were made by mutual agreement among the teachers themselves. The first grade had two Auditory and two Visual classrooms; the 2nd and 3rd grades had one Auditory, one Visual and one Control classroom. Initially, there were nearly equal numbers of Auditory, Visual, and Either children in each classroom.

The results of the study were as follows:

The study hypothesis was accepted in Grade 1. Children who showed an auditory preference achieved significantly higher when auditory decoding techniques were emphasized on initial presentation in addition to the designated teacher instruction of the Ginn 360, and Visual children scored significantly lower in the same milieu. Visual children, on the other hand, achieved significantly higher when visual decoding techniques were emphasized on the initial presentation of each objective of the lesson plans on the Ginn 360 Reading Series and Auditory children scored significantly lower in the same milieu.

In the 2nd and 3rd grades the study hypothesis was not accepted; the small n of these grades was not sufficient to prevent normal attrition over the time lapse of the study to cause sampling error. Therefore, the experimental conditions were not acceptable to test the study hypothesis. Specifically, in the 2nd grade the random assignment of children to the three classrooms at the beginning of the school year did not maintain similar classrooms by the end of the year because of loss of subjects due to the attrition mentioned earlier and also because of incomplete data on some subjects. The two experimental classrooms were significantly different on the pretest achievement test as well as IQ. Interpretation of the results of these classrooms, however, led to the possible serendipidous discovery of the power that visual decoding techniques hold as a factor of success with children who are low in auditory and/or visual perceptual ability. The design of the study for the purpose of testing the study hypothesis did not necessitate controlling for teacher effect. Therefore, the positive finding relative to the high degree of gain made by all of the children in the Visual classroom is somewhat confounded. It is felt by the present investigators, however, that the results of the 2nd grade clearly call for further exploration of this particular facet of the relationship of modality preference and development and instructional techniques.

The sampling error in the 3rd grade resulted in a three-way interaction between sex, classroom, and modality status and provided no information relative to the study hypothesis, nor did the results provide information relative to sex differences since the interaction was based primarily on single observations.

It is acknowledged that this study's positive results in the 1st grade provide the first experimental confirmation of the concept of individual differences in modality development and that these differences may be met to benefit the child by adjusting early reading instruction. It is certainly not suggested by the present investigators that the results be immediately generalized to the entire population. It is suggested, however, that there may be two primary factors that differentiated this study from the other studies and perhaps facilitated the positive outcome.

One of the factors relates to the high degree of content validity of the tests that were designed specifically to measure the perceptual parameters as they were operationally defined by the Wepman model. For example, there is no motor component involved in the perceptual tasks that are involved in the tests. Also, there are three tests that together define and articulate each of the identified auditory and visual perceptual processes. The tests were in the process of research and development for several years before their reliability and validity were felt to be adequate for assessing perceptual ability in school age children. Earlier studies by the present investigators (Wepman, 1960; Wepman & Morency, 1971; Morency, 1968; Turaids, Wepman & Morency, 1972) using earlier versions of some of the same tests had shown significant relationships to reading achievement.

The selection of the subjects of the earlier studies (Robinson, 1972 & Bateman, 1968) that were similar to this present study was on quite a different base than the selection of subjects for this study. It should be noted that in the Robinson study (1972) only the Wepman Auditory Discrimination Test was used to determine auditory preference. At the time the data for her study was collected, the Auditory Discrimination Test was the only perceptual test that had been standardized. There was evidence of a strong relationship between that test and reading performance in the early elementary grades (Wepman, 1958). However, it has since been found that auditory memory and sequential memory are essential components to "fill out" auditory perceptual modality functioning (Morency, 1968; 1973). In addition, the visual tests selected for use in the Robinson study were of quite a different nature than the visual tests used in this study. All of the Goins' tests used by Robinson were group pencil and paper tests and thus added a motor component although not a visual motor component. Also, they are considered to be gestalt tests incorporating part or whole approach to problem solving. The abilities that are tapped by these tests are not consistent with the Wepman model of perceptual functioning. The tests used in the Bateman (1968) study were the auditory and visual sequencing subtests of the Illinois Test of Psycholinguistic Ability. Here again is a case of selecting the experimental subjects on the basis of only one component of the overall perceptual processes.

A second major difference between the present study and former studies relates to the differences in ways that the instructional intervention was carried out. All of the former studies used different reading series. For example, the Robinson study was conducted in schools that had been using their particular reading series for many years. The reading series were well accepted by the teachers at the respective schools and were quite different in approach to teaching word attack skills in early grades; one being more visually oriented and one being more phonically oriented. It is felt, however, that such factors as separate schools, separate neighborhoods, different supervision of teachers and the like actually may have clouded the issues of the hypotheses of Robinson's study. However, the innovative approach utilized by this study--that of adapting one reading series to the specifications of the two modality related treatments has provided all of the classrooms with a high degree of uniformity of instruction.

Another related component that may provide insight into the positive results of this study as opposed to the other studies was the exceptionally enthusiastic participation of the teachers who were involved in carrying out the intervention. Their wholehearted support, willingness to spend much time and energy in thinking through and planning in advance, provided this study with a coordinated approach consistent with the theoretical model and with as balanced intervention as was possible.

All of these factors contributed to reducing some of the error in this experimental test that otherwise would be categorized as "naturally occurring". There are, of course, shortcomings to this study that in future investigations should be avoided in order not to replicate the problems that were encountered. Perhaps the most blatent shortcoming in this study was in the size of the population of the study. It will be recalled that it was the small n that led to the disappointing sampling error of the 2nd and 3rd grades. There is no way of guaranteeing the stability of an enrollment in a school over the time lapse of a school year. The larger the n the greater insurance that randomization of the population into the treatment groups will not be disrupted by random attrition. An ideal situation in which to test the matching, mismatching of modality preference and modality related teaching techniques of course would be the participation in the experiment of several schools. In so doing, the interpretation of results with a view to generalizing confirming results into present day educational philosophy would be more readily accepted by those who are charged with the implimentation of educational innovation.

It is felt by the present investigators that additional experimental tests of the modality concept as it relates to normal children in normal classrooms should have a high order of priority with research oriented educators. In addition to an adequately sized population, further improvements that are suggested by this study but not actually tested by it, concern the ages that meeting modality related individual differences may be most effective. It was felt by the present investigators that logically the period of optimum influence on a child would probably be the 1st grade. If this proved to be the case, a second year, reversing the intervention and matching and mismatching the children would provide information relative to the degree children responded to such intervention. It would also provide information on whether getting a good start in learning to read would be reflected by maintaining that lead in the grades that follow.

There was no way in this present study to determine whether prior exposure to reading instruction influenced the effectiveness of the experimental intervention of the study as it was designed. Results of the 2nd grade study, though clouded by the fact that teacher effect did not need to be controlled for the design of this study, (therefore it was not) would suggest that in some instances such as dealing with children who are low in perceptual development, modality related instructional intervention may be of value later than 1st grade. This is certainly consistent with the Wepman modality concept.

Although in Grade 1 the study hypothesis was accepted and Grade 2 may have provided some additional information relative to the perceptual basis for learning, the discussion of the results has been liberally punctuated with recommendations that further exploration into the various nuances suggested by the results of this study are clearly indicated.

In conclusion, the present authors reiterate this recommendation and add that the positive results of this study add a factor of urgency to the need to not only replicate this study but further explore the vast possibilities that may lie ahead in the field of modality related educational practices that may have far reaching effects on the school children of the future.

APPENDIX A: Additional Training Manual for New Administrators of the PTB

APPENDIX B: Lesson Plans that Coordinate with Instruction Book for Teachers, Ginn 360 Reading Series

APPENDIX C: The Test Battery - Description of the tests used in the Study.

APPENDIX D: Tables 14, 15 (Grade 1)
Tables 31, 32 (Grade 3)

APPENDIX A

Additional Training Manual for New Administrators

of

The Perceptual Test Battery

The Battery is made up of three auditory and three visual subtests or six subtests in all. Each subtest is to be given and scored separately to one student at a time.

Before administering any subtest be certain you have recorded the child's name (and coded serial number if one is being used) on the score sheet for that test. This will help by keeping each child's efforts in proper order.

Each examiner should familiarize herself with the test materials and the printed instructions for administering the test before giving the tests.

Each child should be tested separately in a quiet room. Provision should be made for the physical comfort of both child and examiner as to light, ventilation, etc.

There is no rigid rule regarding physical placement of child and examiner; however, it is important to have a table and two chairs. The examiner may sit beside, around the corner, or across the table from the child.

AUDITORY TESTS

Be certain the child understands what he is to do in responding to the tests; i.e., he must know the meaning of Same and Different before taking the Auditory Discrimination Test, he must know that he only needs to repeat the words in any order for the Auditory Memory Span Test. He must know that he is expected to repeat the numbers in the same order (sequence) that he hears them in the Auditory Sequential Memory Test.

Be sure you can understand the child's responses. Accuracy or correct articulation is not necessary but it is often difficult to understand a child if his hand covers his mouth or if he's holding his head up with his hand.

The child should not be in a position where he can see your face when taking the Auditory Discrimination Test--he can be seated in such a way that he can hear but not see your face as he listens. The Auditory Memory Span and Sequential Memory Tests are given with the child and examiner face to face. The child is to be seated where he can read the printed test words or numbers.

Read words and numbers clearly in a natural voice--DO NOT OVER-ENUNCIATE or OVER-EMPHASIZE.

When reading words and numbers it is important that you do not rush or overly slow down. The timing is stated for each test. Practice timing so that it becomes automatic before giving tests.

Be sure the child hears you--ask him if you have any doubt. Read each word-pair, word or number sequence only once. DO NOT REPEAT. If a child indicates he hasn't heard you for any reason, or, if you believe he was not paying attention or, if he asks you to repeat, say: "We'll come back to that one" and go on to the next item. Return to the item in question at the completion of the test.

Read the words and number sequences aloud to yourself before giving the auditory tests to familiarize yourself with them. Rehearse each test with a view to keeping the inflection of the sequence up in the auditory discrimination test and letting it drop in the memory and sequencing tests.

Be sure to tell the child to wait for your signal before he responds. The signal most often used is merely to look at him after you have read the stimulus words or numbers.

APPENDIX B

LESSON PLANS THAT COORDINATE WITH INSTRUCTION BOOK FOR TEACHERS, GINN 360 READING SERIES (CLYMER, 1969)

Level 3, Auditory

Unit 1, Overall unit objectives

1. Discriminating phonemes /p/, /b/, /t/, /d/ in initial position.
2. Detecting phonemes /p/, /t/, /d/ in final position
3. Detecting phonemes /k/ and /g/ in final position.
4. Detecting /k/ and /g/ in initial position.
5. Detecting /m/ and /n/ in initial position.
6. Detecting phonemes /m/, /n/ in final position.
7. Detecting glided vowel sound /ay/ in medial position.
8. Detecting unglided vowel /i/.
9 Detecting phoneme /h/ in initial position.

Activities

"AT THE PARK" p. 6-9

Obj. 1

a. Tp. 36 Decoding activity 1: O.K.
b. Tp. 37 Decoding activity 2: modify last part of the activity by having the teacher say the pairs of words, the child deciding which one begins like "Bill" or "pig", then the child finding the correct word on the board.
c. Tp. 38 Decoding activity 3: O.K.
d. Tp. 38 Decoding activity 4: modify - don't write any of the words until they have first been done auditorily.
e. Tp. 40 Decoding activity 1: O.K.
f. Tp. 41 Decoding activity 2: O.K.
g. Tp. 41 Decoding activity 3: O.K.

"THE DUCKS" p. 10-15

Obj. 1

a. Tp. 49 Decoding activity 1: modify - always say the word; do not put on the board.
b. Tp. 52 Decoding activity 1: O.K.
c. Tp. 53 Decoding activity 3: O.K.

Obj. 2

a. Tp. 50 Decoding activity 2: O.K.
b. Tp. 51 Decoding activity 3: modify - be sure to say all example words rather than writing them on board.
c. Tp. 53 Decoding activity 2: modify - say all words; do not put on board.

"LAD" p. 16-19

Obj. 3

a. Tp. 59 Decoding activity 1: modify - use only the last 2 parts of the activity; do not use pictures for the last part. Let the child name any possible answer beginning with /k/ and /g/.
b. Tp. 60 Decoding activity 3: modify - do auditory discrimination on all words before putting them on board.
c. Tp. 61 Decoding activity 4: modify - do not use initial part of the activity involving the sentence on the board. Begin with the activities where the child repeats the words with the final /g/ sound.

Obj. 3 & 4

a. Tp. 64 Decoding activity 2: O.K.

b. Tp. 64 Decoding activity 3: O.K.

"LAD HELPS" p. 20-23

Obj. 5

a. Tp. 71 Decoding activity 1: modify - do not use pictures for the first part of the activity. Secondly, when the picture cards are distributed, have each child name his picture and then choose another child to give the beginning sound.
b. Tp. 72 Decoding activity 2: modify - say all words; don't put any on the board.
c. Tp. 75 Decoding activity 3: O.K.

Obj. 6

a. Tp. 72 Decoding activity 3: modify - say words rather than putting them on the board.

Obj. 7

a. Tp. 73 Decoding activity 4: O.K.
b. Tp. 74 Decoding activity 2: O.K.

Obj. 4 & 5

a. Tp. 74 Decoding activity 1: modify - use pictures put not letter cards; say all words and have the child name beginning and ending sounds.

Level 3, Visual

Story "The Ducks" from text A A Duck is a Duck.

A. Decoding Activity 1 p. 49 o.k. but write the words first

B. Decoding Activity 2 p. 50 (OBJECTIVE 1)

1. Listening for /p/ in final position

   a. Remember the children must see the words and see the p in final position first. Then read words with them and they look at and listen for the /p/ in final position. USE HOLDERS AND LETTER CARDS!

   b. In the story about the ape (bottom of p. 50 col. 2) write words in green letters on board for all to see the letter p in final position.

C. Decoding Activity 3 p. 51 (OBJECTIVE 1)

1. Listening for /t/, /d/ in final position
2. Discovering phoneme-grapheme correspondences /t/t/ and /d/d/ in final position.
3. Discriminating between the correspondences /t/t and /d/d in final position.

   a. Use transparencies and children first look at all the groups and they'll see what they are asked to do.

   b. Use holders and t cards.

D. Decoding Activity 1 p. 52 Adjusting to Individual Needs (OBJECTIVE 1)

1. Discriminating between /t/t and /d/d in initial positions.

   a. List names for pictures, read them and have children see and trace over their sandpaper letters.

   b. Classify picture cards-under t or d whatever phoneme and grapheme they begin with.

   c. Say a few words such as tan, tame, ton, Ted, Dan, dame, done, dead, which are written on the board.

E. Decoding Activity 2 p. 53 (OBJECTIVE 1)

1. Discriminating and reinforcing sound letter correspondences /t/t and /d/d

   a. Use transparency and use each group of 2 words thus. Say, "I'll read both words and you watch and listen, but I'll read one of them twice. You tell me which one it is---the first one or the second one Use 1 2 cards and show me."

Ex:	sat	sad--sat--sat	(2)
	hit	hid--hid--hit	(1)
	card	card--cart--card	(1)

F. Decoding Activity 3 p. 53 ADJUSTING TO INDIVIDUAL NEEDS
  1. Discriminating between initial /t/ and /d/

    a. Do as directed, but write the words used.

    b. "Words that begin with /t/ begin like top. Words that begin with /d/ begin like dog. Let's say these and say either top or dog after them."

tell-take-toad-two-tick
tune-tap-toss-tail-tall
time-tin-tiny

---

dime-dog-dig-Dick-down
dance-dive-dust-deck
dip-day-den-dead

Story "Lad" TE 55-65

A. Decoding Activity 1 (OBJECTIVE 2) p. 59
  1. Associating initial sounds /k/ and /g/ with c, C, g, G.

    a. "Write the green letter words (bottom of 59) on the board and children see they begin with the letter c and can guess and hear the sound?"

    b. "Do they start like car-our key word?"

    c. "Do they begin like goose?"

B. Decoding Activity 2 p. 60
  1. /k/ sound with letters c and k

    a. Use transparency and say, "LOOK at these words." They begin like car and kite our key words."

C. Decoding Activity 3 (OBJECTIVE 3) p. 60
  1. /k/ in final position

    a. Do as directed but stress the fact that children LOOK at the last letter of the word - K or cK

    b. Use transparency

D. Decoding Activity 4 (OBJECTIVE 2) p. 61
  1. /g/ in final position.
  2. Previewing /g/g correspondence
  3. Discrimination between /g/ and /k/ in final position.

    a. Let children see the groups of words on the transparency.

    b. For 8 groups of words on the lower part of p. 61, col. 2 use 1 2 cards. Say, "Now I will read these two words, but I will read one of them twice. You tell me which one it is--the first or second." Then proceed: Dick--dig. (Child should point to the card with #1 on it.

E. Decoding Activity 1 ADJUSTING TO INDIVIDUAL NEEDS
OBJECTIVE 2 - p. 63
  1. Discriminating between /k/ and /g/ in final position.
    a. This is difficult for many children. Be sure and make the bulletin board as a visual aid.

F. Decoding Activity 2 (OBJECTIVE 2) p. 64
  1. /k/ k and /g/ g in both initial and final positions.
    a. Better to have these words on a transparency and let the children SEE as well as hear in what position letters s, k and g are.
    b. Work with holders and letters for entire group participation.

G. Decoding Activity 3 INDIVIDUAL NEEDS p. 61
  1. Sounds /k/ and /g/ in initial position.
    a. Write words to LOOK AT.

Story "Lad Helps" T.E. p. 66

A. Decoding Activity 1 p. 71
  1. Perceiving /m/ and /n/ in initial position.
  2. Discriminating between /m/ and /n/ in initial position.
  3. Associating initial sounds /m/ and /n/ with the corresponding letters m, M and n, N.
    a. Write the word mother and then use picture card. Also write nurse before picture card and pronunciation.

B. Decoding Activity 2 p. 72
  1. Perceiving and discriminating between /m/ /m and /n/ n
    a. Write word mother first. Then proceed as directed.
    b. Adapt same procedure for no.
    c. Proceed with pairs of rhyming words as done in b. of D. Dec. Act. 4, p. 61 (revised for visual)

C. Decoding Activity 3 p. 72 (OBJECTIVE 4)
  1. Perceiving /m/ and /n/ in final position.
  2. Discriminating final /m/ and /n/ from other sounds.
  3. Discriminating between sound letter correspondences /m/ /m and /n/ n in final position.
    a. Use transparencies so children can LOOK AT as well as hear the correspondnces.
    b. Proceed according to T. E.

D. Decoding Activity 4 p. 73 (OBJECTIVE 6)
  1. Glided /ay/ long i sound as in hide.
    a. Write hide. Say, "You can see the letter i in hide. Do you hear the sound that is the same as that letter's name?"

b. Follow similar procedure for ride.

c. So down the alphabet for other words containing glided /ay/ as in hide.

Ex. bike-dime-find-glide
high-jive-kind-light
mind-nine- etc.

E. Decoding Activity 2 p. 74 (OBJECTIVE 6)

1. Reinforcing perception of glided vowel sound /ay/.

a. Have story ready to show about Mike.

Ex. Mike lives far from school.
Mike rides his bike.
Mike likes his kite too.
He likes to eat rice.
His all I know about Mike.

F. Decoding Activity 3 p. 75

1. /m/ and /n/ in initial position.

a. Make a ditto of the six sentences, give to the children and they see and point to m and n before teacher reads the sentences.

Appendix C

THE TEST BATTERY

This section discusses each of the tests used in the study. The tests are as follows:

The Perceptual Test Battery:

The Perceptual Test Battery is made up of six sub-scales, three in the auditory mode and three in the visual. Table 1 shows the distribution by perceptual areas tested.

Table 1

Sub-scales of the PTB

Auditory Modality	Visual Modality
1. Discrimination (sounds)	1. Discrimination (forms)
2. Memory (words)	2. Memory (forms)
3. Sequencing (numbers)	3. Orientation (forms)

Auditory Discrimination Test

Auditory Discrimination as assessed by this test is defined as the individual's perceptual processing of aural signals (heard speech) contrasting each phoneme heard with each other phoneme so that even the finest differences between sounds can be separately distinguished.

The form the test takes is to ask the subject to listen to word-pairs read aloud and determine whether the two words he hears are the 'same' or 'different'. The test consists of forty such word pairs. Thirty are 'different' one from the other within the word-pairs. The difference in each instance is a single discriminating feature. Ten pairs show their difference in initial consonant position (bat-kat); ten in the medial vowel position (loud-lead) and ten in the final consonant position (cap-cat).

Ten additional word-pairs are identical. Each word-pair was selected from comparable section of the Thorndike-Lorge Word Count (1944), and according to that published frequency list, are approximately equally familiar to children.

Examples of Word-Pairs:

Initial	Medial	Final
rug-lug	peel-pale	beg-bed
bead-deed	leap-lope	bun-bum
met-net	come-came	rake-rate

Auditory Memory Test

This is a test of a subject's ability to recall one-syllable words spoken in progressively increasing series. The ability to retain and recall series of familiar but unrelated words (immediate auditory memory span) is found to be closely related to the ability of small children to read. In company with auditory discrimination, this perceptual process appears to be developmental in nature, i.e., increases with age.

The subject is asked to repeat the words he hears beginning with a set of two words and continuing progressively through a series of six words. No meaningful relationships exist between the word series; i.e., each word is spoken out of context with preceding or following words. The words used were all selected from the five-year old frequency listing of A Spoken Word Count (Children), (Wepman & Hass, 1969), and while not completely equated for familiarity, are known to appear in the vocabularies of five-year olds. All words used are common nouns, pronouns and adjectives. Three trials are given at each level. Order of recall is not scored. The weighted score is derived by crediting achievement on each of the first, second, or third trial.

Example:

Dog - . . . . Shoe
House - . . . Tree . . . Person
Man - . . . . Cup. . . . Car . . . . Hat

Auditory Sequencing Test

This test is the familiar digit span (forward) sub-test used in many test batteries. Recall of digits is used as a method for assessing sequencing ability rather than word recall.

The child is asked to listen to a series of numbers and repeat them exactly in the order in which they were heard. Two trials are given at each level. The weighted score is derived by crediting achievement on each trial of each level.

Example:

9 . . . 6
3 . . . 7 . . . 4
8 . . . 2 . . . 5 . . . 6

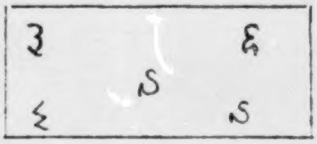
Visual Discrimination Test

This is a test designed to assess the subject's ability to judge relatively fine differences in visually presented forms. The test consists of 20 items, with a "target" in the center, and the responses in the four corners of the same page. Error types are based on Gibson's transformations (Gibson et al, 1962) with perspective and size errors not represented. Addition and deletion of features are used in balanced subsets. The child's task is to point to the peripheral figure "just like the one in the middle," and the training items give examples of each kind of error. The task tends to be easy, but the item format avoids the usual way of "making it harder": right to left arrangements of distractors, with an attractive alternative to the left of the correct response.

This common arrangement, because of the common occurrence of response sets among young children, permits the examiner to note patterned responses.

The ability to discriminate form differences is developmental, i.e., the ability increases with age in some few children up to the ninth birthday. The test is scored simply by counting the number of correct discriminations made.

Example:



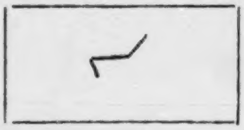
Visual Memory Test

The test is designed to measure immediate recall of free forms not easily identifiable by name. Immediate recall of visually presented forms is developmental in nature, i.e., an increased number of correct recalls is noted at each age up to the ninth birthday.

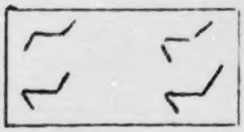
The assessment task used is a target form presented for five seconds followed by a multiple-choice presentation of forms including the target form. Error types are the same as in the Visual Discrimination Test, except that rotation errors are excluded. The task requirement is simple pointing to the form recalled. There are 16 items. The test is scored by counting the number of items correctly recalled.

Example:

Target



Response



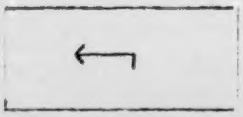
Visual Orientation Memory Test*
(Free Forms)

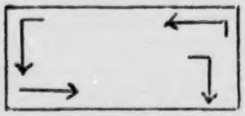
A test to assess a child's ability to immediately recall the orientation (direction) of forms. Research has demonstrated that this specialized recall is closely related to learning to read (Wepman, Turaids, Morency, 1972).

The format used is identical to the Visual Memory Test. A target page is followed by a multiple choice page with four presentations of the target --one of the four pointing in the same direction as the target--the other three are reflections or rotations of the target. The child's task is to recall and point to his choice that is exactly the same as the target.

The test will be available for distribution after study of its reliability and validity are completed.

Example: Target Response





*Experimental form - not presently available for distribution.

Achievement Tests

The Metropolitan Readiness Test evaluates the pre-reading skills of Kindergarten children. A task oriented description of the six group, paper and pencil tests is as follows:

Test 1: A child selects from three pictures the one that illustrates the word the examiner names.

Test 2: The child selects from three pictures the one which portrays a situation or event the examiner describes briefly.

Test 3: The child marks one of three pictures which matches a given picture or the same task substituting words for pictures.

Test 4: The child chooses a letter of the alphabet named by the teacher from four alternatives in his test booklet.

Test 5: The child chooses an answer in his booklet from four alternatives.

The items are concerned with quantitative questions such as identification of time displayed on faces of clocks, how many, monetary value, printed digits, simple addition, subtraction, multiplication and division problems. The teacher asks the questions.

Test 6: The child must copy various geometric forms, numbers and letters in the space provided.

Individual test scores may be derived as well as a total score. The total score was used in this study. The test is timed.

The Metropolitan Achievement Tests: Primary I Battery is designed for use in the latter half of grade 1. The three subtests that relate to reading skills were used in this study. A task-oriented description of each test is as follows:

Word Knowledge: The child selects a word from several printed words the one that identifies a pictured item. There are 35 items.

Word Discrimination: The child selects an orally presented word from a group of words with similar configuration. There are 35 items.

Reading: (Part A) - The child demonstrates his ability to read and understand sentences by choosing from among three sentences the one that correctly describes a picture. There are 13 items to this section.

Reading: (Part B) - The child demonstrates his comprehension of material of paragraph length by reading a given selection and answering questions in a multiple choice format. This section has 33 items--a total of the two parts of the reading subtest. There are 48 items. The test is timed.

The *Metropolitan Achievement Tests: Primary II Battery, Forms A & B* are designed for use in grade 2. Only the subtests of this battery that relate to reading skills were used in this study.

Word Knowledge: A 37-item test visually presented that measures word recognition and understanding. On the first 17 items the child demonstrates his recognition of a word by selecting one from several printed words that correctly identifies a pictured item. The remaining 20 items, a stimulus word is presented in an incomplete sentence (i.e., A mat is a ___) and the child demonstrates his understanding of this word by choosing from among four alternative responses.

Word Discrimination: A test that measures the child's ability to select an orally presented word from among a group of words of similar configuration.

Reading: (Part A) - The child demonstrates his ability to read and understand sentences by choosing from among three sentences the one that correctly describes a picture. There are 13 items in this section.

Reading: (Part B) - The child demonstrates his comprehension of material of paragraph length by reading a given selection and answering questions in a multiple choice format. This section has 33 items--a total of the two parts of the reading subtest. There are 48 items.

The Gates-Mac Ginitie Reading Tests: Primary B, Forms 1 and 2 is designed for use in the 2nd grade. Two of the subtests are used in this study. A task-oriented description of the tests are as follows:

Vocabulary Test: The child identifies from a multiple choice printed format the word that best corresponds to the picture for that item. There are 48 items of increasing difficulty in that the choice words become more similar in details and general appearance.

Comprehension Test: This test utilizes whole sentences and paragraphs. The child must grasp the total thought clearly if he is to answer correctly from a multiple choice panel of four pictures. The child must identify the picture that best illustrates the meaning of the passage or answers the question in the passage. There are 34 items.

The Gates-Mac Ginitie Reading Tests: Primary C, Forms 1 and 2 is designed for use in the 3rd grade. The two subtests used in this study were:

Vocabulary Test: This test begins with 12 items which contain four printed words and a picture illustrating the meaning of one of the words. The child's task is to choose the word that best corresponds to the picture. This section is followed by 40 items, each consisting of a test word followed by four other words, one of which is similar in meaning to the test word. The child's task is to choose the word that means most nearly the same as the test word.

Comprehension Test: This test measures the child's ability to read and understand whole sentences and paragraphs. This ability includes many skills not involved in the mere ability to recognize words. The child must grasp the total thought clearly if he is to answer correctly. The test contains 24 paragraphs of increasing length and difficulty. Each paragraph is followed by two questions with four alternative answers for each question. The child's task is to circle the best answer for each question.

The Lorge-Thorndike Intelligence Tests: Level 1 for Kindergarten and Grade 1 - This is a group test using pictorial materials and oral instructions. There are three subtests.

Test 1: The teacher or test administrator says a word and the child is instructed to draw a circle around the picture that illustrates the spoken word. (Auditory stimulus, visual response.) There are 25 items.

Test 2: The child is expected to identify which one in a series of five illustrations is different, which one does not belong (visual stimulus and response.) There are 20 items.

Test 3: The child is asked to identify, out of a series of five items, which two go together (visual stimulus and response.) There are 20 items.

APPENDIX D

TABLE 14

ESTIMATED CELL MEANS INCLUDING COVARIATE ADJUSTMENT FOR DEPENDENT VARIABLES BASED ON REORDERING OF HYPOTHESIS

Grade 1 Group Means			Dependent Variables		
Sex	Classroom	Mod. Status	Word Know.	Word Discrim.	Reading
Boys					
	Auditory	A	29.49	28.43	27.43
		V	26.32	25.42	20.57
		E	26.04	25.34	24.12
	Visual	A	27.85	22.51	18.82
		V	28.07	28.20	21.85
		E	29.41	27.47	23.72
Girls					
	Auditory	A	30.73	29.05	32.19
		V	30.95	28.60	30.72
		E	30.73	29.51	36.41
	Visual	A	29.16	23.25	24.68
		V	30.23	29.82	29.44
		E	30.81	28.28	29.39

Note: Dependent Variables - Metropolitan Achievement Test, CA & IQ.

TABLE 15

ESTIMATED COMBINED MEANS & CORRELATIONS (WITHIN GROUP) INCLUDING ADJUSTMENT FOR COVARIATE FOR DESIGN MODEL BASED ON REORDERING OF HYPOTHESES

Grade 1 Groups		Word Knowledge	Word Discrimination	Reading
Overall		29.15	27.11	25.49
Sex				
Boys		28.07	26.01	22.73
Girls		30.22	28.21	30.24
Classroom				
Auditory		28.81	27.75	28.74
Visual		29.48	26.47	24.23
Modality Status				
Auditory		29.59	25.55	26.08
Visual		28.88	28.36	25.89
Control		28.99	27.42	27.49
Sex x Class				
Boys -	Auditory	26.89	25.89	23.89
	Visual	29.26	26.13	21.58
Girls-	Auditory	30.73	29.60	33.59
	Visual	29.71	26.82	25.89
Within Group Correlations		3.79	5.60	10.81
Sex x Mod. Status				
Boys	Auditory	30.50	25.67	26.17
	Visual	27.39	27.72	22.00
	Control	26.33	24.63	20.03
Girls	Auditory	28.69	25.44	26.00
	Visual	30.32	28.99	29.78
	Control	31.65	30.21	34.94
Class x Mod. Status				
Aud.	Auditory	30.44	28.94	31.25
	Visual	28.32	27.64	26.14
	Control	27.67	26.67	28.83
Vis.	Auditory	28.75	22.17	20.92
	Visual	29.39	29.08	25.64
	Control	30.31	28.17	25.14

TABLE 31

ESTIMATED COMBINED MEANS INCLUDING COVARIATE ADJUSTMENT ON POSTTEST SCORES

Grade 3

Source		Vocabulary	Comprehension
Overall		38.20	35.24
Sex			
Boys		37.14	34.11
Girls		39.25	36.37
Classroom			
Auditory		38.71	39.37
Visual		41.46	38.79
Control		34.42	27.56
Modality Status			
Auditory		36.92	34.35
Visual		39.22	35.56
Control		38.45	35.82
Classroom x Modality Status			
Auditory	A	41.45	39.42
	V	38.50	41.00
	C	36.17	37.70
Visual	A	41.55	37.38
	V	38.00	35.00
	C	44.83	44.00
Control	A	27.75	26.25
	V	41.17	30.67
	C	34.33	25.75

TABLE 32

ESTIMATE OF EFFECTS FOR THE DESIGN MODEL ADJUSTED FOR COVARIATES

Grade 3	Estimates & (Standard Errors)	
Source	Vocabulary	Comprehension
Overall	13.13 (15.89)	-22.69 (21.27)
Sex	-0.09 (1.51)	1.04 (2.02)
Classroom (1)	-2.89 (1.48)	-5.28 (1.99)
Classroom (2)	-0.48 (1.15)	2.16 (1.55)
Mod. Status (1)	0.47 (1.15)	0.60 (1.54)
Mod. Status (2)	-0.66 (1.28)	-0.79 (1.71)
Sex x Class (1)	-0.63 (2.61)	-0.07 (3.50)
Sex x Class (2)	2.07 (2.20)	2.45 (2.94)
Sex x Mod. Status (1)	1.54 (2.48)	3.29 (3.32)
Sex x Mod. Status (2)	-2.77 (2.64)	0.79 (3.53)
Class (1) x Mod. Status (1)	-0.16 (2.11)	-2.35 (2.82)
Class (1) x Mod. Status (2)	-8.54 (2.37)	-0.62 (3.17)
Class (2) x Mod. Status (1)	-2.90 (1.85)	-3.09 (2.48)
Class (2) x Mod. Status (2)	-0.23 (2.02)	-0.16 (2.70)
Sex x Class (1) x Mod. Status (1)	1.61 (4.55)	2.10 (6.10)
Sex x Class (1) x Mod. Status (2)*	-7.96 (4.70)	6.48 (6.30)
Sex x Class (2) x Mod. Status (1)	1.81 (3.72)	2.75 (4.98)
Sex x Class (2) x Mod. Status (2)	-6.79 (4.46)	-1.62 (5.97)

*Significant interaction

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